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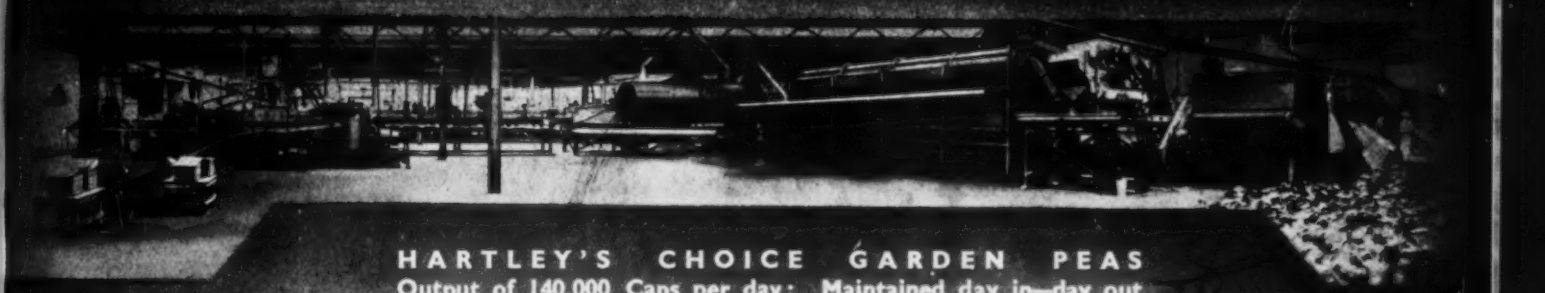

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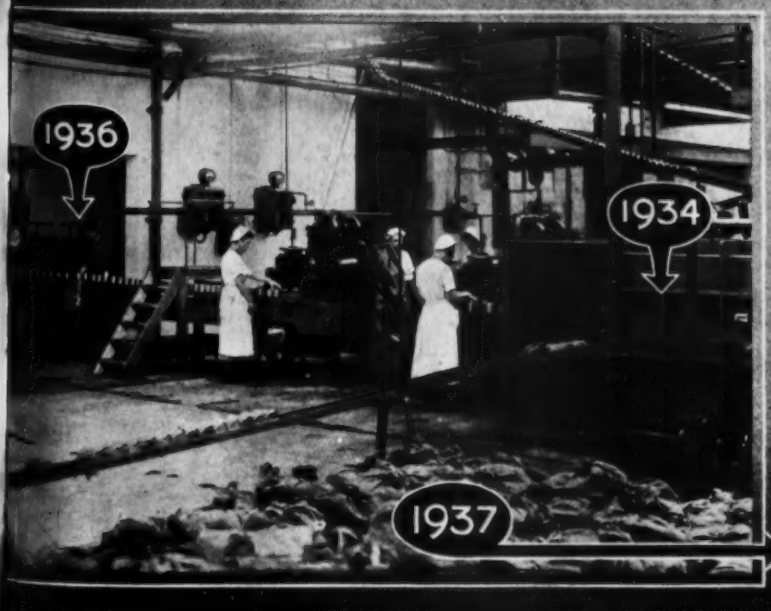

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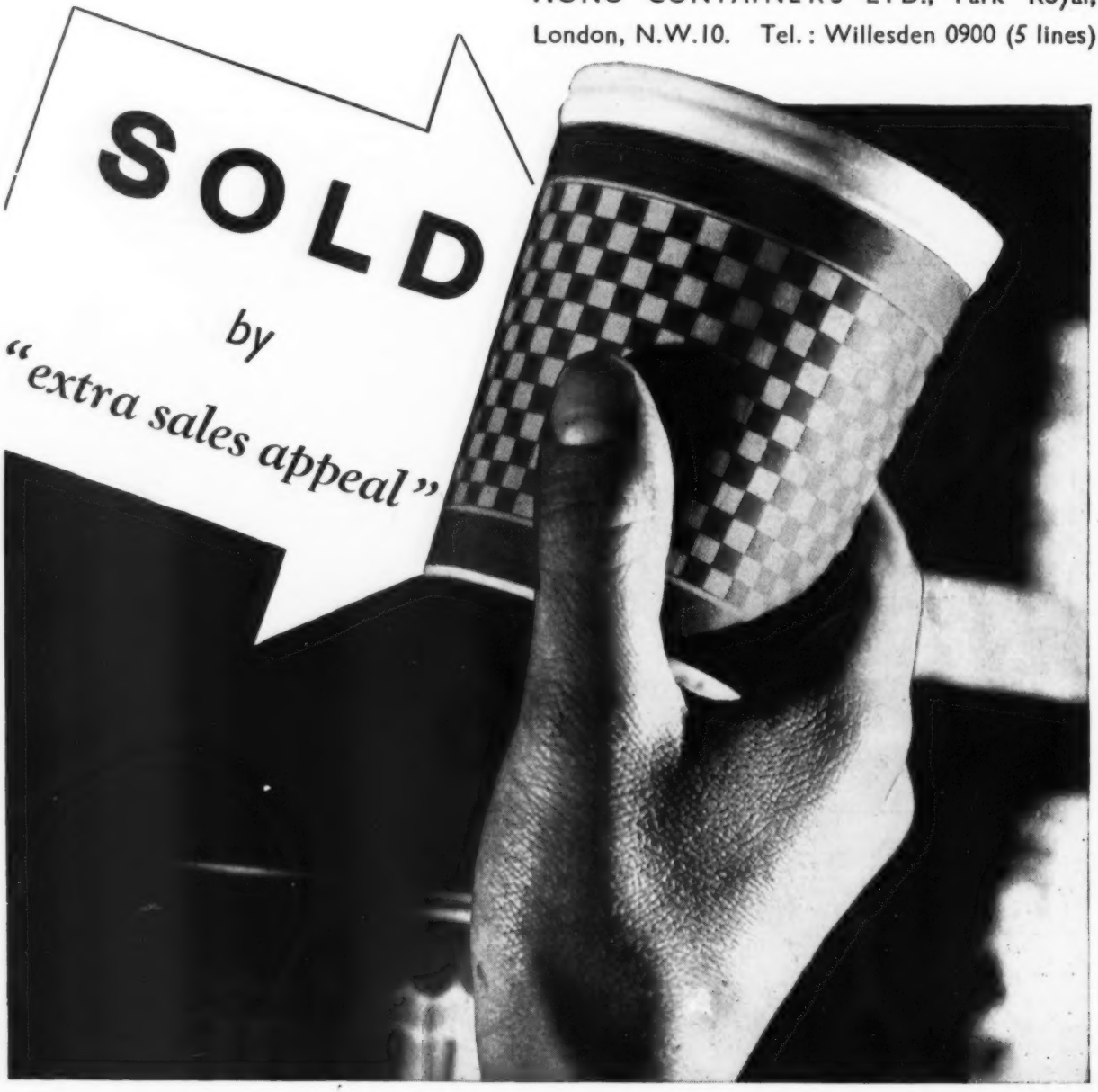

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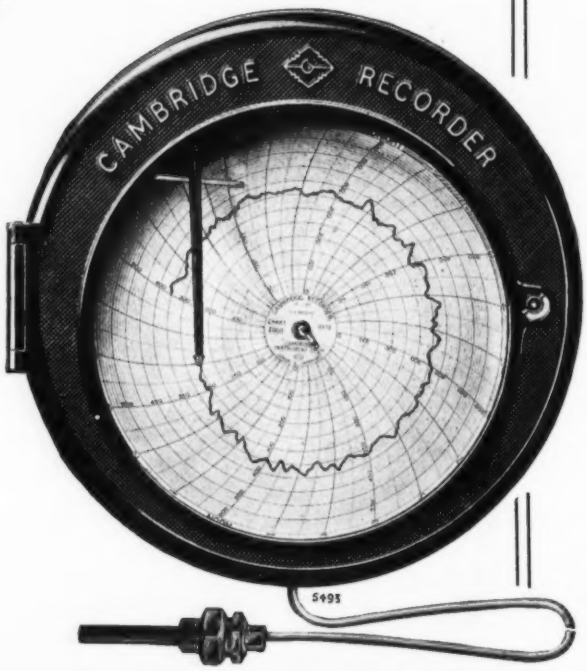

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FOOD MANUFACTURE

Vol. XI, No. 11 November, 1936

Canning Progress

CANNED GOODS continue to be regarded by the public at large as still in the experimental stage of development. Yet as a method of preserving foodstuffs canning is really a very old one. It is also a fact that the scientific study of the processes of canning foods and of the effect of the processes upon the foods and upon their nutritive value has followed far behind the actual working out of the basic principles of canning as a process of preservation. This may to some extent account for the attitude of the public. They have not been given sufficient scientific evidence served up in a suitable form to dispel the false notions that remain in circulation. People are to-day very receptive to popular scientific education, especially to the form that is broadcast. We therefore hope that at the Conference of the Annual Canners' Convention being held in Liverpool on Wednesday, November 4, consideration will be given to the popular appeal as well as to a "Publicity scheme for removing professional prejudices against canned foods", which is the subject on the agenda.

Whilst the canning industry is undergoing a process of scientific refinement, we cannot therefore look for a revolution in the course of a year, much less half a year, the time that has elapsed since we last devoted a considerable amount of our space to contributions on this subject. Bread and cheese and beer (a happy combination!) are the latest foods to be sealed up in a can. The canning industry has already risen to the pilchard situation. The sale of canned beer is progressing steadily, and no less than eighteen breweries are now offering twenty-four different beers in cans in this country. Perhaps the easy-opening can with the scored band is the most useful advance of recent introduction so far as cans are concerned, and an attempt is now being made to use this type of can for fruit and vegetables as well as for meat and other products for which it has been utilised up to the present.

Standardisation of Cans

Writing to us from Warsaw, Dr. D. J. Tilgner, who is Director of the Standardisation Bureau of the Food Products Laboratory in Poland, puts forward a strong plea for an agreement between canners in all countries to simplify tin containers and in general to reduce the sizes to a few in number. As he says: "The prime function of a container is to protect its contents perfectly in a convenient form and with due regard for economy. The simplification of cans brings many proven advantages to the manufacturer and the producer, such, for example, as more economical manufacture, better scheduling of work, more accurate cost accounting, longer runs on processing units, simplified packing, ease of training employees, resulting in greater skill of workmen, simpler and therefore better inspection of finished products, less capital tied up in raw materials and semi-finished stock." On the side of the wholesaler and retailer, Dr. Tilgner points out that there accrues increased turnover due to concentration of stock, staple lines being easier to buy and quicker to sell. There is less likelihood of obsolescence and fewer misunderstandings. A decreased amount of capital is required for maintenance of stock because there would be fewer complete lines to carry. Furthermore, on the consumer's account, Dr. Tilgner argues that he would obtain better value for his money and better protection against unscrupulous traders. As a matter of fact, some attempt has been made in Poland during the past few months to establish standard can sizes for fish, vegetable and fruit products. The Standardisation Bureau forms part of the Association of Polish Chambers of Industry and Commerce.

Canned Reserves

It is pleasing to note that the campaign for national reserves of foodstuffs which we launched early this year is now being carried out actively on other fronts. The need for the provision of a re-

serve of canned foods was stressed recently at a luncheon given to Mr. Percy Machin, who had for twenty-nine years been chairman of the canned goods section of the London Chamber of Commerce prior to his retirement last year. Those food manufacturers who are concerned with canning will remember that Mr. Machin was chiefly responsible for steering the canned goods trade through its troublesome early days. Even in 1914 enough progress had been made to demonstrate that canned goods were an essential factor in emergency rations. Since then more progress has been made and there is no need now to regard canned goods as emergency rations, they are just ordinary essential, pure and palatable foods. This being so, and in virtue of their keeping qualities, it is obvious that a substantial reserve should be built up in case of need. In such circumstances there is probably no food more reliable and certainly more nutritive than canned food. The size and shape of the containers can be so adapted as to enable the maximum amount of food to be stored in the minimum space, and the canning industry lends itself to a gradual increase of production for the purpose of building up any agreed surplus.

Food and Defence

Nevertheless, we do not feel at all optimistic about the official attitude towards the building up of reserves of foodstuffs for the eventuality of war. We have heard nothing from the Minister for the Co-ordination of Defence except that something is being done about it, and one's fears that the question of food supplies would receive attention last instead of first look like being justified. Why is it necessary to be so secretive about any plans to deal with our food supply, which is the most vital supply service of all, when the plans to expand armaments of all descriptions are advertised by repeated announcements? We should hate to think that we in this country should be asked to subscribe to a campaign of "guns instead of food" like the people of Germany are at present. We may hope that the new session of Parliament will bring forth reassuring statements from the minister concerned.

Estimation of Vitamins

The study of vitamins and the discovery of their occurrence, biological function and constitution has grown during the last decade to the proportions of a separate science. Twice this year, at their April and September meetings, the American Chemical Society has collected a Symposium of papers on Vitamins to be given before a joint meeting of the Division of Agriculture and Food, Biological and Medicinal Chemistry. The connection between the three groups is obvious from consideration of the functions of vitamins. Recently the Food Group of the Society of Chemical Industry in this country arranged the presentation of four papers by eminent workers in this field at the first meeting of the session held in London on Wednesday, October 14 last. The subject of the meeting was "Chemical and Physical Methods of Estimation of Vitamins in Foods". Various aspects of the estimation of, or rather the evolution of methods of estimating vitamins A, B_1, C and D from the purely biological assay to the direct and more useful chemical or physical form of test were dealt with by the various authors. The length of time occupied in the biological assay limits the testing of food products in this respect to the scope of the largest manufacturers and those specialising in the production of vitamin concentrates. But when the methods of determination have been brought to the routine laboratory stage manufacturers will be able to estimate and control the vitamin contents of a very much wider range of food products.

Devaluation of the Franc

Our Paris correspondent informs us that one of the effects which has been the most feared in France since the devaluation of the franc is the increase in the cost of food products. Taking immediate action, the government removed a certain number of quotas, especially on many imported goods, and reduced import duties by 15 to 20 per cent. The quota removals will concern sweetened infants' food, chick-peas and certain grains, especially millet, mustard, spices and sauces, including piccalilli. Further removals of quotas are threatened if prices rise unduly, but with farmers complaining for some time past the devaluation may well be taken as an excuse to let farm prices rise a little. On the retail side, however, the government would like to prevent rises as much as possible. With a view to maintaining the public confidence it has printed and issued to all shops which ask for them small placards reading: "This shop has undertaken not to raise its prices on account of the monetary law." Prices will also be closely watched, and proceedings taken against anyone trying to profiteer. It seems likely, therefore, that prices will rise a little, especially in imported articles, but there seems little possibility that the government will permit the increases to reach any serious point.

Another Jam Problem

The jam problem indeed seems to be a sticky one, and somebody is continually finding something to argue about. The latest find is that of the City Analyst for Salford, who has discovered about 75 parts of sulphite preservative per million in blackcurrant jam which was labelled "New Season". This raises the tricky question of what is jam, particularly new season jam? The Oxford Dictionary claims jam to be "a conserve of fruit, made by boiling it and sugar to a pulp". This definition may serve for the home-made jams which are purely seasonal and only made when the several fruits are available in a fresh condition, and, of course, in domestic operations of this description various other household chores may be put off until the preserving business is finished. Unfortunately the bulk of jam consumed in this country is not home made, and the commercial jam manufacturer is confronted with the conflicting difficulties of a seasonal trade, and keeping a more or less uniform staff of employees. He can either buy as much fruit as possible when it is cheap and work his factory overtime, or he can buy fruit pulp from firms who have preserved the surplus fruits usually with some form of bisulphite. In the latter case he has to add a dye (usually quite harmless) to correct the bleaching action of the SO_2 and also pectin and sometimes citric or tartaric acid to supplement the natural acidity.

A Tricky Question

The point at issue is this. Suppose a manufacturer buys a consignment of blackcurrant pulp, say, in September this year, and converts it into jam and puts it on the market at once. Is he justified in calling it "New Season Jam"? He has made it at once from freshly obtained pulp and marketed it immediately. Some manufacturers evidently have taken the view that this does really justify the designation of New Season Jam. But on the other hand a person buying in October blackcurrant jam which was labelled New Season Jam would naturally expect it to have been prepared from blackcurrants that had actually been grown in the same summer. Jam made from fresh fruit and sugar is clearly defined—fresh fruit must be fresh and presumably of recent harvest, but pulp for jam making may be of any age, and to call jam made from this new season is misrepresentation to say the least of it. It might be quite possible for a manufacturer to put out "New Season" strawberry jam in May at, say, 9d. per lb. when actually the fresh fruit was fetching something like 5d. a lb. for dessert purposes. We agree that the Food Manufacturers' Association and the Society of Public Analysts have done much by a healthy co-operation to improve the quality of jam, and at any rate to give the purchaser some genuine idea of the nature and purity of the jams offered for sale. It is evident, however, that much more needs to be done. Modern research has shown that fresh fruits can be kept fresh by controlled temperatures and atmospheric conditions, and a wider use of these principles may enable jam manufacturers to spread their production over a longer time. While we realise the great difficulties of the jam manufacturer, we do feel it is improper to call jam "New Season Jam" when it may have been made from pulp several years old.

Lean Harvest

In our last two issues we have referred to the results of this year's harvest. The final reports, taken in conjunction with our previous ones, indicate that it has been a bad farming year all round judged from crop yields. In *The Times* Special Reports we find that many correspondents in different parts of the country remark that it has been "a disappointing harvest", "a really bad year so far as arable farmers are concerned", and even "the worst year since 1912 on the Yorkshire Wolds". The corn harvest has dragged on wearisomely even into late October, and much corn, particularly barley, has been ruined by the wet. In the case of wheat, which (as far as yield is concerned) has not suffered so badly, the average yield per acre has been estimated at slightly less than 32 bushels per acre—well below the average of recent years. In some areas the yield is very much below this average, the counties on the south coast have suffered most, though Norfolk and Suffolk have also poor returns. Essex and Cambridgeshire have come above the average in yield, but the quality of the wheat is much inferior to that of the last few years. Oats, still an important crop in the north, have yielded only moderately. Barley we refer to in the next paragraph. Roots have flattered but to deceive. Potatoes gave a big crop, but blight has taken its toll, and there is a heavy wastage among the non-immune varieties such as the popular King Edward. The roots of beet are plentiful, but how much sugar they will produce remains to be seen; we estimate less than usual. The only bright spot is an abundance of grass, and it is pitiable to see lush meadows with grass growing away from the stock, owing to the scarcity of fat cattle. Perhaps the results of this year may

bring the problems of agriculture into more correct perspective.

Malting Barley

Farmers have had much to say in recent times about the brewers failing to observe their "gentleman's agreement" in regard to the consumption of home-grown barley. We have referred to this subject on other occasions, and have pointed out that brewing is a specialised industry and must have the right quality raw material. Unfortunately English-grown barley is very much at the mercy of the weather, but, while we deeply sympathise with the growers about this we cannot blame the brewers. We do not believe that English brewers would search the world for barley if the right type was available at home. This season has been very disappointing for farmers who have specialised in barley. The crops were wonderfully heavy, and an average yield of 37 bushels to the acre was notched —well above the average of recent years. But much of the grain is badly discoloured by rain and not of good malting quality. Much of the barley had to stand in the stook for several weeks, and such grain is spoiled for malting and can only be used for stock feeding. We understand, however, that in some parts, particularly East Anglia, there is some excellent malting barley. In view of the many statements to the contrary the figures published in the *Brewing Trade Review* recently are of interest. According to this organ, during the year ended June 30 the brewers purchased 7,729,000 cwt. of home-grown barley against 7,458,000 cwt. in the year previously. The purchases this year have, therefore, exceeded the limit of 7½ million cwt. agreed upon between the National Farmers' Union and the Import Duties Advisory Committee as a suitable purchase of home-grown barley to warrant the suspension of import duties. In spite of the large amount of rain-damaged barley, it is to be hoped that in the coming year the brewers will be able to make use of as much or more home-grown barley.

Honey

Our note on Honey in last month's issue of Food Manufacture has brought some useful comments from Mr. R. O. B. Manley, author of *Honey Production in the British Isles*. Referring to the question of heather honey, he states that all true heather honey should be from ling (*Calluna vulgaris*) whether produced in Scotland or elsewhere, but its quality varies according to locality and subsoil. Bell heather honey is a very different product which often is preferred by some persons. True heather honey from ling is totally different in consistency and is not extractable by centrifugal force, whereas bell heather or, as some call it, "heath" honey is. Mr. J. Pryce Jones, who is one of the leading authorities on this subject, has carried out extensive researches on the thixotropic qualities of different honeys. This means the jellifying of honey at rest which turns liquid again when stirred. He has discovered that this only exists in the honey from British calluna. Some honeys may be more dense or viscous—*e.g.*, the manuka of New Zealand—but even an almost pure sample of this is not thixotropic. Honeys from the ericas are relatively thin. According to some authorities there is a real difference between the heathers of various localities, and apparently the heather of the Midlands, judged at any rate on thixotropic quality and flavour, produces the best heather honey in the world.

A Strange Diet

Some very interesting and informative leaflets are issued periodically by the I.C.I. Game Research Estate at Knebworth, and one of recent production deals with the hand-rearing of partridges, in which the virtues of ants' eggs are extolled. As long ago as 1581 reference was made to this in Maskall's "Husbandlye Ordering and Governmente of Poultrie", where it is stated, "also if you take the partridge eggs and set them under a hen that sitteth she will hatch them and bring them forth and nourish them like house chickens. They must be fed with ants' eggs till they be of more strength and of a good bigness". But though the value of the ant eggs as food for young partridges has been known for so long, the reason for this value has only been discovered recently after a considerable amount of research. It was first thought that vitamin A might be the essential element present, and an investigation was made to determine the amount, if any, of vitamin A present. It was found that there was none at all and, moreover, the carotin content was only about one per cent. of that found in grass. Hence the efficacy of these pupæ as food for partridges did not depend on the presence of either vitamin A or its precursor. The value of the eggs apparently lies, not in the direction of vitamins, but in nutrition value and digestibility. They contain an extremely high content of nutritive and digestible substances easily assimilated by partridge chicks. Work of this nature is extremely interesting, and is all part and parcel of the general problem of nutrition and nutritive substances.

MICROBIOLOGY *of* FRESH *and* CANNED FOODS

By Professor Fred W. Tanner

Department of Bacteriology, University of Illinois, U.S.A.

FRESH FOODS

FRESH FOODS are those which are in their natural state and which have not been subjected to special treatment, other than refrigeration perhaps, to make them keep. In some countries they present little, if any, sanitary hazard because they are raised on soil which, in general, is not polluted. Night soil or sewage is not used in most countries for fertiliser. The use of sewage sludge as fertiliser has, however, introduced hazards not recognised by some. Warnings,[1] however, have been issued that it should be used with greatest care, because several investigators, particularly Ruchhoft,[2] have shown that *Eberthella typhosa* may survive therein for a considerable time. Ruchhoft has warned us that application of sewage sludge to soil on which fresh vegetables are grown should be practised with caution.

Great military and economic emergencies through which nations have passed have done much to develop interest in various methods of food preservation. Older methods have been revived or brought nearer perfection and new methods have been introduced. There has never been a time in the world's history when as fine foods have been available as to-day. Variety and quality of foods have added much to the life of peoples of all nations.

Cold Storage

Fresh foods are perishable and are subject to rapid bacterial spoilage unless stored under conditions which will repress development of bacteria. One of the best methods available both to the home maker and commercial food preserver for keeping fresh foods is refrigeration. Low temperatures do not completely destroy bacteria, but they do so inhibit them that foods may be kept for long periods. The Committee on Foods of the American Public Health Association (Proctor, B. E., Chairman)[3] has indicated the marked hygienic significance of refrigeration. Since low temperatures will not destroy all bacteria, it is necessary that attention be given to bacterial numbers and types in foods which are to be preserved in this manner. In general, cold storage is most successful with foods which are in their natural wrapping. Those which have been worked over in such a manner as to distribute bacteria throughout will have much shorter life. Refrigeration is making a great contribution to better foods in American homes. In the committee report mentioned above it is stated that over 5,000,000 mechanical refrigeration units have been placed in homes throughout the United States. Each of these units serves to maintain constant low temperatures, which materially aid in conserving quality and safety of foods.

Preservation by Freezing

A relatively new venture in preservation of fresh foods is freezing. Although a few fruits have been preserved by freezing for decades, only within the last ten years has this method been extended to practically all foods. The newer methods have substituted "quick freezing" for "slow freezing". The relative merits of these methods will not be reviewed here. Several reports of results of investigations indicate that freezing to a solid state does not sterilise foods. Frozen foods must, therefore, be considered to be perishable and must be stored under conditions which will keep them frozen. The Committee on Foods of the American Public Health Association made the following statement on this matter:

> "Unless low temperatures are maintained until the products are about to be used, spoilage will occur and health hazards may result. This is well known in respect to unrefrigerated foods, which may be kept only for limited periods, but it applies equally to those which have been refrigerated or frozen."

Results of numerous investigations on microbiology of frozen foods have been published during the past five years. Results[4] secured with pure cultures of micro-organisms and some 2,000 cans and cartons of frozen fruits and vegetables show that while freezing does result in a marked reduction of bacterial numbers, frozen foods may contain large numbers of micro-organisms. Spores and toxin of *Clostridium botulinum* were found to be resistant to freezing.[5] This places a responsibility on those who freeze foods to use only fresh raw materials and not to permit them to thaw so that, if undesirable bacteria are present, they may grow.

The temperature at which foods are frozen seems to have little influence on the death rate of micro-organisms in them. When cultures were stored at temperatures between 0° C. and −45·5° C. very little difference in

death rate was observed. Storage at temperatures near the freezing point seems to be about as destructive to microbial life as storage at much lower temperatures. Not only may some micro-organisms escape destruction by freezing, but the results of recent investigations have shown that bacteria, yeasts and moulds are able even to grow when held at temperatures well below the freezing point. Smart[6] reported that eight species grew at −8·89° C. (16° F.), while thirteen others grew after the cultures were held at room temperature. Berry and Magoon[7] observed growth of *Pseudomonas fluorescens* and several other fungi at −4° C.; species of *Cladosporium* and *Sporotrichum* grew at −6·7° C. Similar observations have been reported by Haines.[8] Such data indicate that even freezing temperatures are not adequate to keep foods indefinitely. Whether or not bacteria are able to develop in foodstuffs under such conditions should also be studied.

Data which have been published on the effect of freezing on micro-organisms, whether in foods or other menstrua, justify the following conclusions:

1. Bacterial numbers are markedly reduced during the early freezing period.
2. Micro-organisms react quite differently to freezing. Some are harmed and die out quickly. Others seem to be "preserved" by low temperatures.
3. Several species of micro-organisms are able to grow at temperatures which have hitherto been considered to be distinctly inhibitory. These observations were made with pure cultures on laboratory culture media. Whether such organisms would be of significance in foodstuffs is unknown.

One problem concerning frozen foods not always appreciated even by those who distribute them is that such foods must be properly handled. They are perishable and must be kept frozen until used. Hazards are introduced when certain foods are allowed to thaw before use, due primarily to cellular destruction which permits freer access of micro-organisms to the cell protoplasm. Spores and toxin of *Clostridium botulinum* are not affected by freezing. If spores are present they may germinate when the foods thaw to render it toxic.

CANNED FOODS

The art of canning has never been on a sounder basis than it is to-day. Large quantities of foodstuffs of all kinds are preserved by heating in glass and tinplate containers. There is scarcely a food that cannot be purchased in such a container. The home maker, therefore, has available at all times a wide variety of wholesome and nutritious foods which may be purchased when convenient and stored in the home until needed.

The history of the art of canning is generally considered to have originated in the experiments of Nicolas Appert, which were prompted by the need of the French Army for a wider variety and more abundant supply of food. A prize of 12,000 francs did much to inspire his work. It is interesting to point out the fact that the great military and economic emergencies through which nations have passed have played an important rôle in development of the canning industry. In the United States the war between the states from 1861 to 1864 gave new interest to this method of food preservation. The World War of 1914-1918 also did much to advance the art of canning. During the economic emergency through which the nations of the world are passing just now, those who have been concerned with provisioning the peoples have again turned to canning. In the United States, "community canning centres" have been established where the fruits and vegetables raised on "relief gardens" could be preserved. This has meant the appearance of thousands of small scantily equipped canning plants frequently operated by persons without proper appreciation of the principles involved in heat-processing of foods. In many cases foods have been packed which not only did not keep well and were of poor quality but which were hazardous from the standpoint of food poisoning. The large factory canner in America to-day uses the most recent scientific information from chemistry, physics and bacteriology. His art is no longer founded on "rule of thumb" methods but rather on the results of expensive investigations carried out in the laboratory and factory. The Research Laboratories of the National Canners' Association at Washington and San Francisco and those of several of the large container manufacturers are examples of such institutions where have been gathered canning equipment and trained scientists to study canning problems. In this connection I cannot refrain from mentioning the name of Dr. W. D. Bigelow, Director of the National Canners' Association laboratories, who for some thirty years has directed much of this work. Similar investigations are being carried on by Mr. F. Hirst at Campden in England.

While every step involved in canning is important, not all of them are equally important from the bacteriological standpoint. Only those in which bacteria are particularly concerned will be discussed in this paper. Preliminary operations, such as care in harvesting, prompt handling and careful washing, removal of defective portions, have much to do with determination of the bacterial load which will have to be handled later by the heat-process. Consequently these operations are important steps. More study, however, has been given other procedures which must be depended upon to make canned foods keep. Most important among them is the process or heat treatment applied to canned foods for destruction of micro-organisms. Formerly, process times and temperatures were arrived at only by the trial and error method as stated above. To-day, they are secured by consideration of results of the following procedures (Esty):[14]

1. Commercial experience of the industry. This forms a background for procedures mentioned below.
2. Determination of the rate of heat penetration to the centre of containers of various sizes under different conditions of processing.
3. Studies on heat resistance of micro-organisms which may spoil the food and those which may survive to cause food poisoning. Most important among the latter, of course, is *Clostridium botulinum*.
4. Results of inoculated experimental packs processed in different ways. The inoculation used is usually a

typical spoilage organism, spore suspensions of which are so standardised to yield a heat resistance comparable to that of *Clostridium botulinum*.

It becomes apparent, therefore, that selection of process times and temperatures should come only after much careful scientific work, a fact not realised by some who have tried to pack new foods or food products. True it is that experience in the factory before the days of laboratory investigations forms a background for the more recent advances. Formerly, each canner carried out his own experiments to determine necessary heat processes, often with disastrous results. The packer experienced such large losses by lowering process times and temperatures that he either had to go out of business or in the next canning season increase the time or temperature of the process to such an extent that the quality of the product was impaired. To-day, the situation is different. Experimental work is carried out in central laboratories and factories by well-trained men who are able to interpret results of their experiments to the factory canner. Such work has resulted in publication of acceptable processes[9, 10] for quite a few products.

Heat penetration determinations play an important rôle in selection of processes especially for new foods. Only those processes which give necessary amounts of heat in the innermost portion of the can are adequate.

Much study has been given to heat resistances of spoilage bacteria. This work has not been carried out merely to determine what these resistances might be, but to apply such data in selection of processes for new products. Furthermore, when experimental packs are made to determine the effect of different processes, it is necessary to make certain that typical spoilage bacteria are present. Among the most resistant bacteria with which canners have to cope are the thermophilic bacteria. They have been endowed by nature with just those characteristics which make them a menace in the cannery. Bacteria which are important in this respect form very heat-resistant spores, grow anaerobically and have particularly high temperature relations. The last characteristic enables growth in cans which are not properly stored. Credit for discovery of thermophilic spoilage of canned foods (corn) should probably go to Barlow,[11] who in 1912 prepared a thesis for the master's degree at the University of Illinois in which his epochal discovery was reported. This work was never published in any other way and it is a pleasure to announce that plans are now being completed for early publication in its entirety.

Inoculated experimental packs play an important rôle in processing studies. Results secured from such studies help to relate those secured in the laboratory and those in the factory under actual packing conditions. One of the first results of studies on heat penetration and studies on heat resistance of spore suspensions was the calculated "theoretical process". The latter must be tested by use of experimental packs after thorough checking. Finally, recommended processes are secured.

Sterility of Canned Foods

Canned foods were once considered to be sterilised foods devoid of living, viable micro-organisms, and their wholesomeness was believed to be indicated largely by absolute freedom from living bacteria. This position has had to be abandoned and a new terminology introduced to indicate the various conditions which may obtain in canned foods. Since heat treatment applied to canned foods did not destroy all viable bacteria, although the foods kept and remained in good condition, the term "processing" was introduced in place of "sterilisation". Later, the expression "commercial sterility" was introduced to express the bacteriological status of foods which have been subjected to heat treatment and which causes them to remain sound under the usual conditions of storage even though they may contain viable cells. Such viable cells remain dormant in most foods, either never to germinate or to develop much later. They may remain in this condition until the food is consumed. Many viable bacteria are, in general, coccus forms; they have been isolated from several different kinds of products, all of which have received heat treatment which should have sterilised them. Such bacterial forms have been found especially in canned meat products. While several explanations for their presence may be offered, one of the most plausible is that they survive the process in the fat where there may be little water. It is well known among bacteriologists that dry bacteria are much more difficult to destroy than are moist bacteria. This was indicated during the Great War with the lipo-bacterin. It proved to be quite difficult to destroy bacteria suspended in the several oils which were used. Observations of various investigators confirm this fact.

Evidence that small numbers of viable bacteria may occur in canned foods which are sound and safe for consumption is indisputable. The work of Savage, Hunwicke and Calder[12] showed this quite clearly; they also pointed out the complexity of conditions which favoured development of such organisms. Some 10 per cent. of commercial canned meat products have been shown to contain viable bacteria.[13] No longer may the contamination argument be used to explain data which have been published on this question. Mere use of process times and temperatures which should be sufficient to kill bacteria is beside the point. Available evidence points to some factor in the environment of the bacteria in the food as the explanation and not to heat resistance of the organisms themselves. Information on heat resistance of bacteria secured from test-tube experiments may be quite different from that secured in the container itself. This is probably the reason why canning technologists place so much importance on experimental packs of various foods in arriving at processes. Heat resistance should probably be determined in the food product and under conditions which represent as nearly as possible the same heat-penetration problems as might occur in the commercial package.

An important phase of this problem is to determine whether the environment in the food is sufficiently unfavourable to prevent development of viable organisms. Esty[14] has recently said:

> "The question is not whether viable organisms are present in the product, but rather is the food wholesome and merchantable."

Food may be wholesome and merchantable even though it may harbour viable spores; however, they must not

germinate and spoil the food. More work should be done on the ability of non-sporulating bacteria to survive processes applied to canned foods. Furthermore, the question of dormancy of viable spores should be investigated to determine whether the principles hold for the tin can that hold for the culture tube in the laboratory.

Since staphylococci have been definitely connected with food poisoning outbreaks, it has been suggested that presence of these organisms might indicate possible danger. While it is true that staphylococci have been incriminated in food poisoning, there is little evidence that all species function in this manner. One of the great problems at present is to determine whether all species form gastro-intestinal irritants. Ability of any micro-organism to cause food poisoning does not depend on morphology. Definite information must be established by accepted methods that an organism actually forms substances which are toxic when taken by mouth.

The suggestion has been made by those who are inexperienced in the examination of canned foods that contamination of cultures explained these observations. This does not seem to be a valid argument, because practically every investigator who has examined canned meat products, for instance, would have had to work with contaminated cultures. Too many carefully executed investigations have been reported to accept the contamination argument. It is true, indeed, that some investigators may have used careless methods for opening cans, and it is not difficult to explain some of their results on this basis. However, this argument cannot be used to refute results of many recent investigations. Some have also argued in support of the contamination explanation by pointing out that the process given the cans was much greater than that required for destruction of the organisms in the laboratory. It is only necessary to point out that greater differences may exist in experiments on heat resistance carried out in culture tubes than the experiments carried out in food in the tin container. Just how these so-called non-heat resistant bacteria are able to survive in canned meats is unknown. It is known, however, that bacteria are most difficult to kill when suspended in fats. This is well proved by a recent publication by Lang and Dean.[15] When the spores of *Clostridium botulinum* were suspended in fish products packed in oil, much longer times were required for their destruction. Those who wish to read more into this explanation may consult the paper just quoted.

Botulism

While incidence of outbreaks of botulism has decreased somewhat since 1923, a few are caused each year in the United States by home-canned foods. Foods packed in canning factories in the United States have not caused botulism since 1925. Since that date two outbreaks have been caused by imported factory canned foods. This eleven-year record for the United States is enviable, but would not justify relaxation of any effort which has contributed to it. A campaign of education was started two years ago which is helping to correct this situation as far as home canning is concerned. Unfortunately, it seems to be difficult to reach just the people who should be reached. A recent review of outbreaks of botulism in the Rocky Mountain region by Hall[16] indicates again what Meyer[17] previously pointed out, that poverty and ignorance contribute to careless handling of foods and inadequate methods of preservation. Whether the use of pressure cookers with which to sterilise non-acid foods would be of much help is questionable. Some families are not able to afford them, and if they could the problem of proper operation still remains. Possibilities of such a situation does not justify, however, dissemination of unsound advice on heat processing by those in position to give it. Many of those who preserve vegetables in glass jars are incompetent to detect spoilage, especially when it has not progressed far enough to generate much gas or change the appearance of the liquor in the jar.

The battle of botulism may be won by educating the public to the best methods of canning in the home and boiling all home-canned foods before they are eaten. Outbreaks of botulism in the United States for 1934 and 1935 are given in Table I. The botulism record in the United States for 1936 already approaches that for previous years. As this is written an outbreak caused by home-canned beans in which four deaths occured is reported from a mid-western state.

It is obvious to technologists in the canned food industry that some instructions on home canning prepared for home-makers do not consider all known bacteriological information. Efforts have been made during the last two years to bring this situation to the attention of home-economics advisers[18, 19, 20] and others who are disseminating advice on home canning. Good advice may

TABLE I.

Location.	*Product.*	*Method of Preparation.*	*Cases.*	*Deaths.*
1934.				
Missoula, Mont.	Beet tops	Home canned	3	3
Baker, Oreg. ...	Spinach	,, ,,	2	2
Walla Walla, Wash. ...	Asparagus	,, ,,	1	0
Springer, N.M. ...	Chili peppers	,, ,,	4	4
Ronan, N.M. ...	Beet tops	,, ,,	2	2
Yakima, Wash.	Beans	,, ,,	22 of 25 chickens affected died	
San Francisco, Calif.	Mushrooms	,, ,,	1	1
San Jose, Calif.	Soy bean paste	,, ,,	5	5
1935.				
Tobe, Col. ...	Probably beets	,, ,,	5	3
Wenatchee, Wash.	Beans	,, ,,	1	1
Scottsbluff, Neb.	Corn	,, ,,	5	3
Sayle, Mont. ...	Spinach	,, ,,	2	2
Morristown, N.J.	Peppers	,, ,,		
The Dalles, Oreg.	Salmon	,, ,,	4	1
Springer, N.M. ...	Green chili	,, ,,	5	4
Trinidad, Colo. ...	Beets	,, ,,	4	2
San Francisco, Calif.	Probably anti-pasto	Imported	10	3
Los Angeles County ...	String beans	Home canned	1	1
Stanilans Co., Calif.	Salmon or corn	,, ,,	2	1
Los Angeles, Calif.	String beans	,, ,,	1	1
Fresno Co., Calif.	Cheese	Home prepared	3	1
Newa k, Ohio ...	Beans	,, ,,		3
Klamath Falls, Oreg.	String beans	,, ,,	4	3

be secured in publications of several states in America[21] as well as in the publications of the Bureau of Home Economics of the U.S. Department of Agriculture.[22]

Somewhat disconcerting are the large number of consumer claims which have been lodged against the canning industry. These have increased in number each year of the depression period, despite the fact that steady improvement has been made in canning technology and can manufacture. The "consumer claim" situation confronting the canning industry is becoming serious. Many of these claims are fraudulent and are filed on the basis that personal injury has been caused by foreign objects in the food or that the canned product has caused food poisoning. Unfortunately, canners and distributors in the past have tried to avoid publicity with attendant loss of good will by settling these claims out of court. The amounts of money involved in individual settlements might be low, but the annual total amounts to an appreciable figure. This practice, however, has probably been responsible in no small degree for the marked increase in the number of complaints filed annually against commercial canners.

It is significant that some of the most serious claims for damages are based on unfamiliarity of medical practitioners with the procedures necessary definitely to establish causative factors in cases of food poisoning. In many such cases convincing evidence is neither sought nor considered. There is pressing need for more general recognition of proper procedure for determination of causative factors in food poisoning. Large amounts of money would be saved and food processors would not be forced to risk their good will.

The full text of a paper contributed by Professor F. W. Tanner at the International Congress for Microbiology held in London from July 25 to August 1. The transactions of the Congress will be published early next year.

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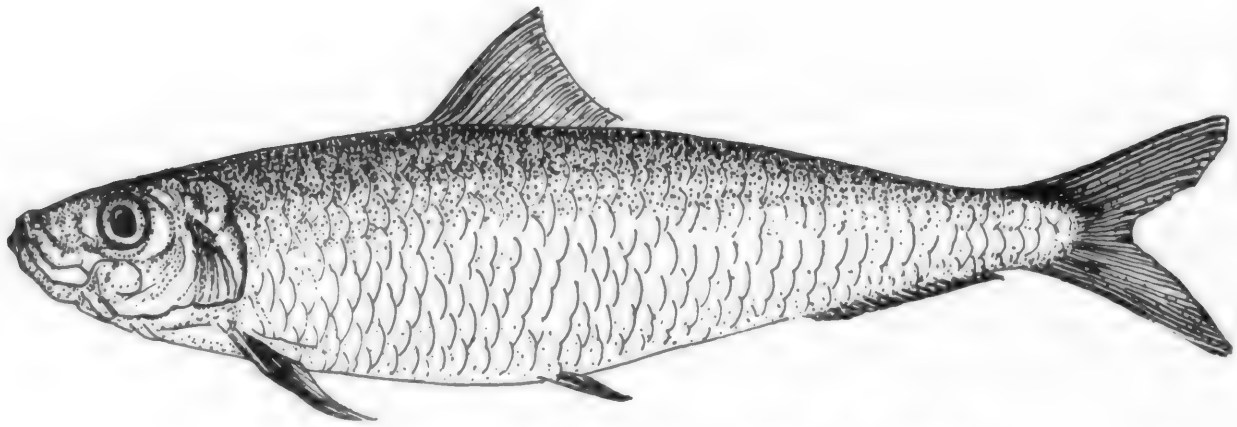
STANDARDISED METHODS OF MEASURING CAN SIZES IN POLAND

The illustrations show the type of gauge used for measuring can dimensions and have been kindly supplied by Dr. D. J. Tilgner, Director of the Standardisation Bureau of the Food Products Laboratory in Poland. Left to right: Measuring depth of cover, controlling the diameter, measuring the countersink, controlling the height of the closed can, measuring the height of the open can.



THE PILCHARD

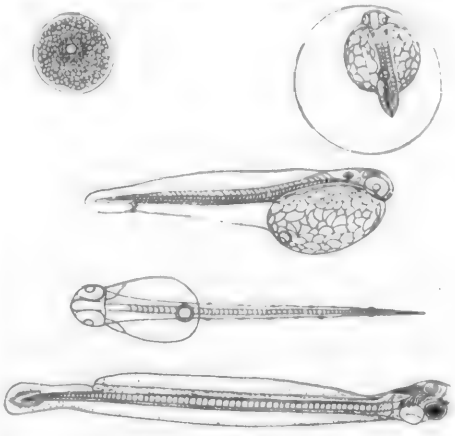
(Clupea pilchardus, Linn)

Its Food Value, Life History and the Modern Method of Preservation & Canning

By ELLIOT B. DEWBERRY, M.R.I.P.H., M.R.Sam.I.

THE PILCHARD, which is a member of the herring family and the most oceanic of any of the race, is to be found in the seas of Western Europe and throughout the Mediterranean. In British waters it frequents the coasts of Devon and Cornwall and the south and south-west coasts of Ireland.

History relates that the pilchard fishing industry of Cornwall is of considerable antiquity, and as early as 1588 regulations were made to try and ensure a satisfactory distribution of the fish and to prevent exportation. This legislation was necessary, as the home markets were stimulated by the large number of national feast days on which it was forbidden to eat meat. Comparatively little preservation and curing, however, took place owing to the great scarcity of salt, which, in later years, was imported from France. The flourishing conditions existing in the West Country in the sixteen, seventeenth, and eighteenth centuries were doubtless largely due to the valuable monopoly of the pilchard fishery, which was the mainstay and support of the inhabitants of that coast.



Top: L., Ova of ripe Pilchard; R., Ova of Pilchard in an advanced stage of development. Second: Newly-hatched larva of Pilchard. Third: Newly-hatched larva with neutral surface uppermost showing sensory papillæ Bottom: Larva of Pilchard 9 days old (after Cunningham).

The pilchards, which Carew describes as being "the least in bigness, the greatest for gaine, and most in number", formerly reached the shallow coastal waters between harvest and Alhallontyde. Their coming was eagerly awaited by all classes of the population, as the large catches gave employment to men and women in cleaning, salting, and pressing the fish. During the years 1747-1757 the total quantity of pilchards despatched from the four principal Cornish ports—Fowey, Falmouth, Penzance, and St. Ives—averaged 30,000 hogsheads, or 90,000,000 of fish annually, but the industry was then, as now, subject to great fluctuations, both as regards prices and the quantity of fish caught.

Inshore "seining" for pilchards (sean or seine nets being the method in use for catching them) developed on a very large scale during the eighteenth century. Immense shoals reached the Scilly Isles and

The pictures throughout this article are reproduced by courtesy of Pawlyn Bros. Ltd. They have been taken at their new pilchard canning factory at Mevagissey, Cornwall, and show the various stages in the canning of pilchards.

Brining tanks, each of which holds about 500 fish. The density of the brine and time of immersion are carefully checked.

Cornwall in July and August, and large numbers of fish were netted at Mevagissey, the creeks of Falmouth and Helford Harbours, and in Mount's and St. Ives Bays; in 1877 the latter bay was the greatest seining centre in the country. The fish were cured with salt and exported to Italy. The season usually commenced in August and lasted until November or even December.

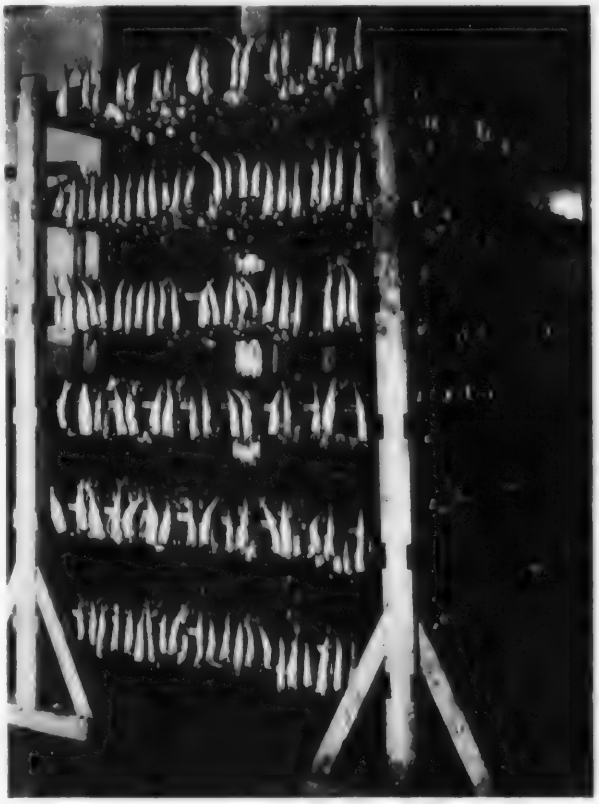
Early Methods of Preservation

The earliest method of preservation was termed "bulking". The fish were tipped out from the "gurries" (boxes with 4-pole handles holding about 1,000 pilchards) on to the ground. These were handed by children to the women, who packed the pilchards in alternate layers of coarse salt on the stone floor of the curing house until the bulk reached a height of 5 or 6 feet. The fish remained salted for about a month, the oil and the brine draining from the mass being carried off by gutters to the cistern. They were then washed, packed in hogsheads with their heads outwards with a "rose" of fish in the centre to keep the level. Gradual pressure was then applied to emit the remaining oil until the contents of the cask had been reduced to one-third in bulk. The cask was thus filled thrice before pressing was finished. The oil was said to have been formerly used for lighting purposes or for dressing leather.

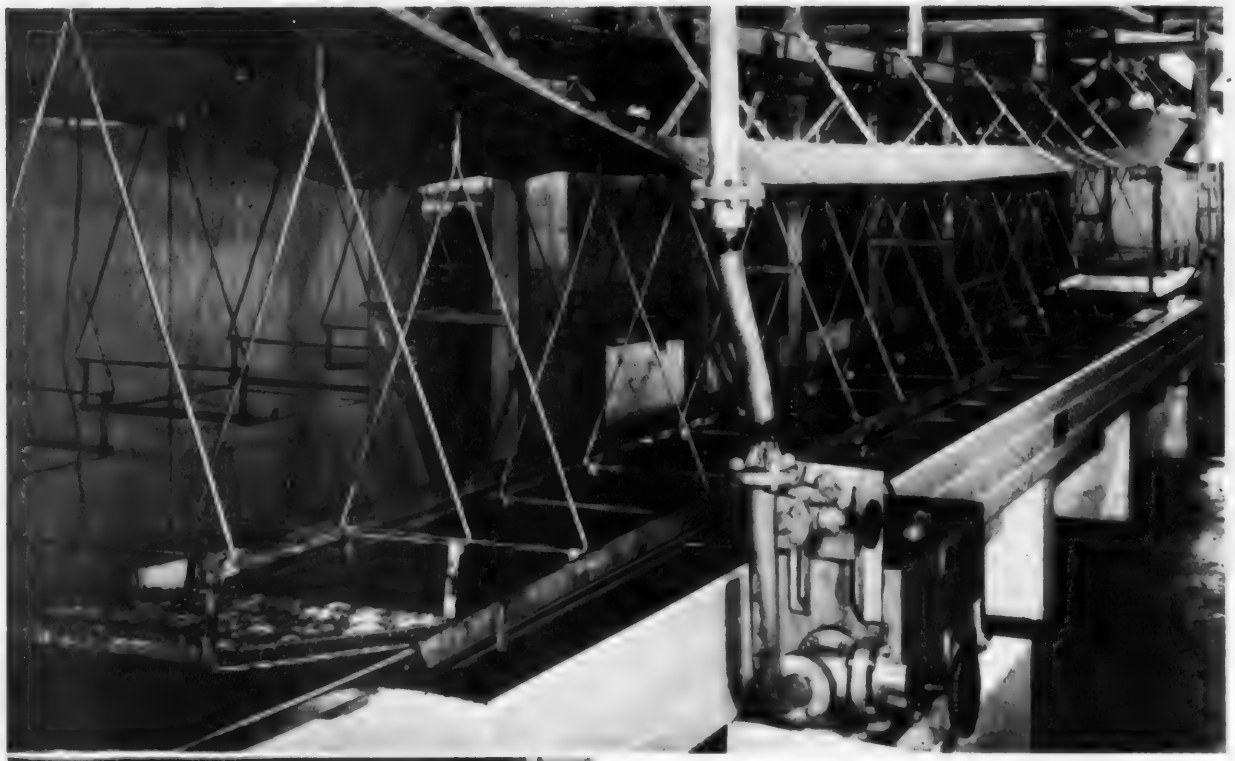
In later years a great change took place in the method of curing, owing to the introduction of salting or curing tanks; "bulking" was no longer carried out. The new process is said to have been first introduced at Mevagissey, and it is a curious fact that not only did the pilchards shortly afterwards desert the bay, but as the use of the tanks became more general the enormous shoals, which formerly frequented the shallow waters of the Cornish coast, were no longer to be seen. The last big catches by the seining method took place in St. Ives Bay in 1907.

The Post-War Revival

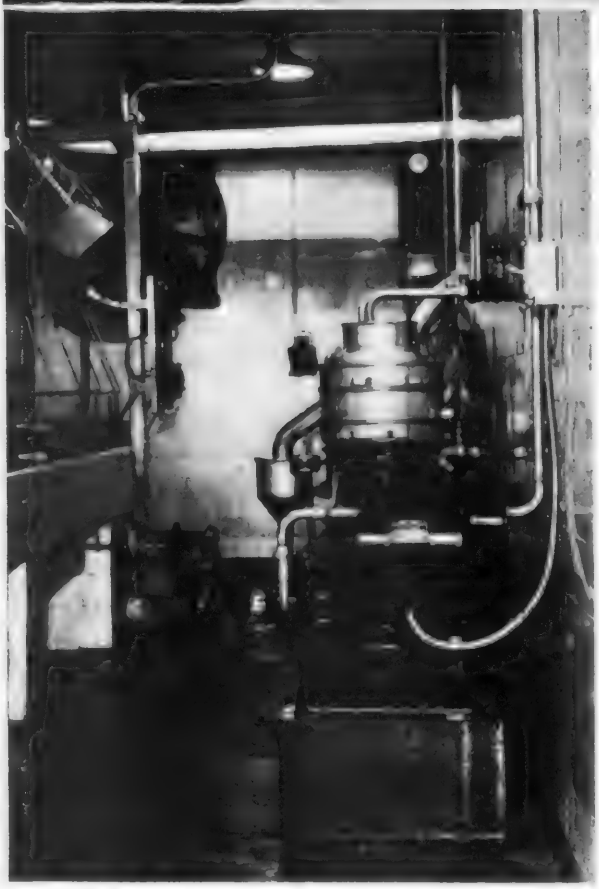
During the Great War seining for pilchards ceased entirely, probably owing to lack of man-power; thus this particular branch of the ancient fishing industry practically became extinct. After the war the pilchard industry still represented an important section of the West-Country fisheries, and in 1929 large catches were landed at the Cornish ports. The fish were caught in drift nets drawn by motor drifters at anything from 10 to 20 miles from the land. Each net is about 80 yards long and 30 to 40 yards in depth. As many as 20 to 30 of these are fastened together, forming a train, fleet, or drift of nets, so that the whole may be a mile or more in length, hanging perpendicularly in the water like a wall of netting. The nets, after being cast or shot, are allowed to drift in whatever direction the tide may take them. As the fish come up with the tide their heads become entangled in the small meshes of the nets, from which they are not easily able to withdraw owing to their gills, which open and operate like barbs. A drifter usually shoots its nets shortly after sunset or just before sunrise, and the vessel lies head on to the nets until



Pilchards on racks after being smoked.



A general view of the frying bath showing a basket of fish about to enter the bath. The Control Panel and the Marilene patent heater are actually on the far side on the right of the picture.



An Alfa-Laval Oil Purifier by which the oil used for frying is clarified and freed from impurities. On the left is seen part of the frying bath.

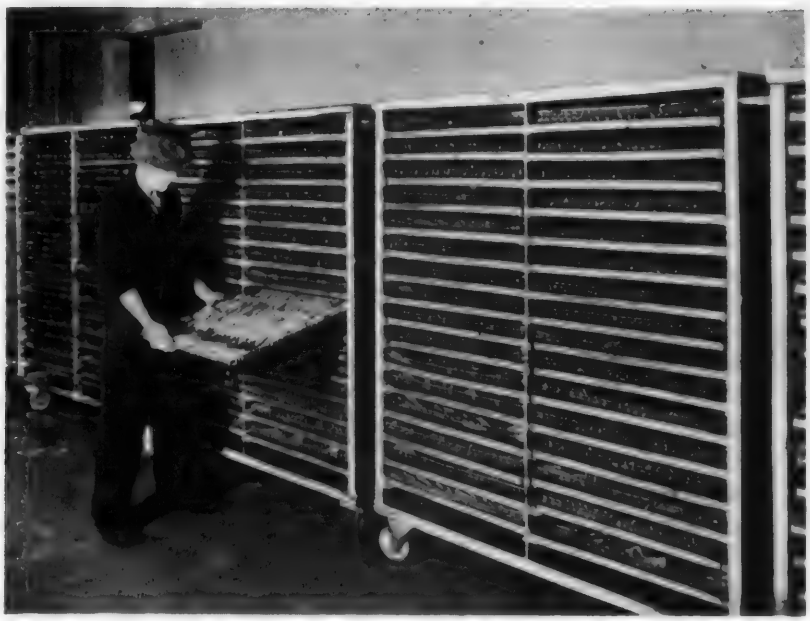
such time as a considerable quantity of fish are found to be enmeshed. The nets are hauled in by a capstan and the catch shaken out. Ten thousand fish is considered a good catch by one drifter.

Pilchard fishing now extends from Wolf Rock Lighthouse, around Mount's Bay to the Lizard, and along the south coast of Cornwall as far as the Eddystone. The season commences in June and lasts well into the autumn. During the height of the season the fish are extremely plentiful, although there may be sharp fluctuations in abundance from year to year. Unlike herrings, pilchards are not captured in the breeding season, but when the generative organs are small and undeveloped the fish are fat and in prime condition.

Recently a stimulus has been given to the Cornwall pilchard fishery by the introduction of up-to-date methods for curing and canning. A model factory has been built at Mevagissey for this purpose and modern machinery and plant installed. This enables an attractive, nutritious, and appetising canned food to be produced and placed on the market at a reasonable price. The new industry is welcomed by the local fishermen and their families, who have been passing through lean times. It is hoped that in the near future the ancient Cornish pilchard fishery will regain some of its former importance.

FOOD VALUE OF THE PILCHARD

This varies considerably with the season of the year, but the following figures give an approximate percentage composition for the flesh of the fresh fish: Water, 60 to 70 per cent.; fat, 18 per cent.; protein, 18 to 19 per cent.



The special cooling and draining racks in which the baskets of fish are placed after frying. Each basket is above its drip tray.

Towards the stage of sexual ripeness the percentage of water and protein decreases, but the fat increases. After spawning the flesh is thin and watery.

The food value of pilchards canned in olive oil depends to some extent on whether the fish were caught in the summer or winter months, and is indicated in the following analyses:

	Water.	*Fat.*	*Protein.*	*Nitrogen.*	*Ash.*	*Total.*
Fish caught in summer ...	55·3	13·6	25·6	15·4	5·2	99·70
Fish caught in winter ...	58·2	9·7	16·0	16·0	5·9	99·80

In addition to the large amounts of protein shown above, the oil (fat), also a source of bodily heat and energy, contains vitamins A and D. Vitamin A is found in the green parts of many water plants and seaweeds, and is stored up in considerable quantity in the oil. The pilchard feeds upon animal organisms near the surface of the sea, and these creatures have in turn fed upon minute floating green plants, in which the vitamin is produced under the influence of the sun's ray. These vitamins make the pilchard a valuable article of food, especially for children, the flesh being nourishing, rich in energy, and easily digested.

The following figures show the quantity of pilchards of British taking landed in England and Wales during 1935:

Quantity, 42,535 cwts.; value, £10,945.

The quantity of cured or salted pilchards exported during the same year was:

Quantity, 37,089 cwts.; value, £48,976.

LIFE HISTORY

Chief Characteristics.—The colour of the pilchard when removed from the sea is olive green to greenish blue, with golden yellowish tints on the upper part of the body and silvery on the sides and belly. It is a soft-finned fish of the body group of fishes, the length ranging from 8 to 11 inches. A specimen of 14 inches has been caught, but this is a rarity.

The pilchard is furnished with one dorsal, two pectoral, two pelvic, and one anal-caudal fins, the dorsal fin being placed a little nearer the head than the tail. The slender body is rounder than that of the common herring and not so deep. The spines of the belly are short and weak, and there is little or no lateral line. The head, which is slightly flattened at the top, is about one-fifth the length of the body, and the large eyes are provided with double eyelids. The lower jaw is larger than the upper, the teeth being minute or even absent. Radiating lines are present on the yellowish tinged gill covers.

The scales, which at first show a lustrous golden colour, easily become detached if the fish is much handled. They are larger than in any other species of the herring family and are placed in pockets, the oblique rows being alternately large and small scales; the latter are concealed by the former in normal fish.

Heading and tailing the fish prior to packing.

Selecting and packing the fish in tins. The conveyor taking the tins to the seamer can be seen between the packers.

Food and Feeding

Pilchards feed almost exclusively upon plankton—*i.e.*, minute vegetable and animal organisms floating or swimming in the sea. In the spring the plankton contains enormous numbers of vegetable organisms, which in turn promote an increase in the number of pelagic animals, such as copepods and other minute crustaceans. The adult fish feed continuously in the spring and early autumn, but from November to March feeding practically ceases.

Natural Enemies

Adult pilchards have numerous enemies and are devoured by dogfish, hake, tunny, and other predatory fishes. Aquatic birds also take their toll of the larvæ and small pilchards, especially gulls, guillemots, and gannets.

Migration

Although at present little is known about the movements of pilchards, there is no doubt that shoaling and migration are primarily connected with the sexual function; the lesser movements, however, appear to be largely determined by the distribution of food and by currents. The adult fish approach the coasts of Cornwall from June to November, but retire to warmer regions as winter approaches.

Breeding and Development

The minute globular, glossy, transparent eggs, each from 1·2 to 1·4 mm. in diameter, are deposited by the female in clusters or masses numbering from 40,000 to 60,000. The egg has three distinct characteristics making it unlike any other in British waters:

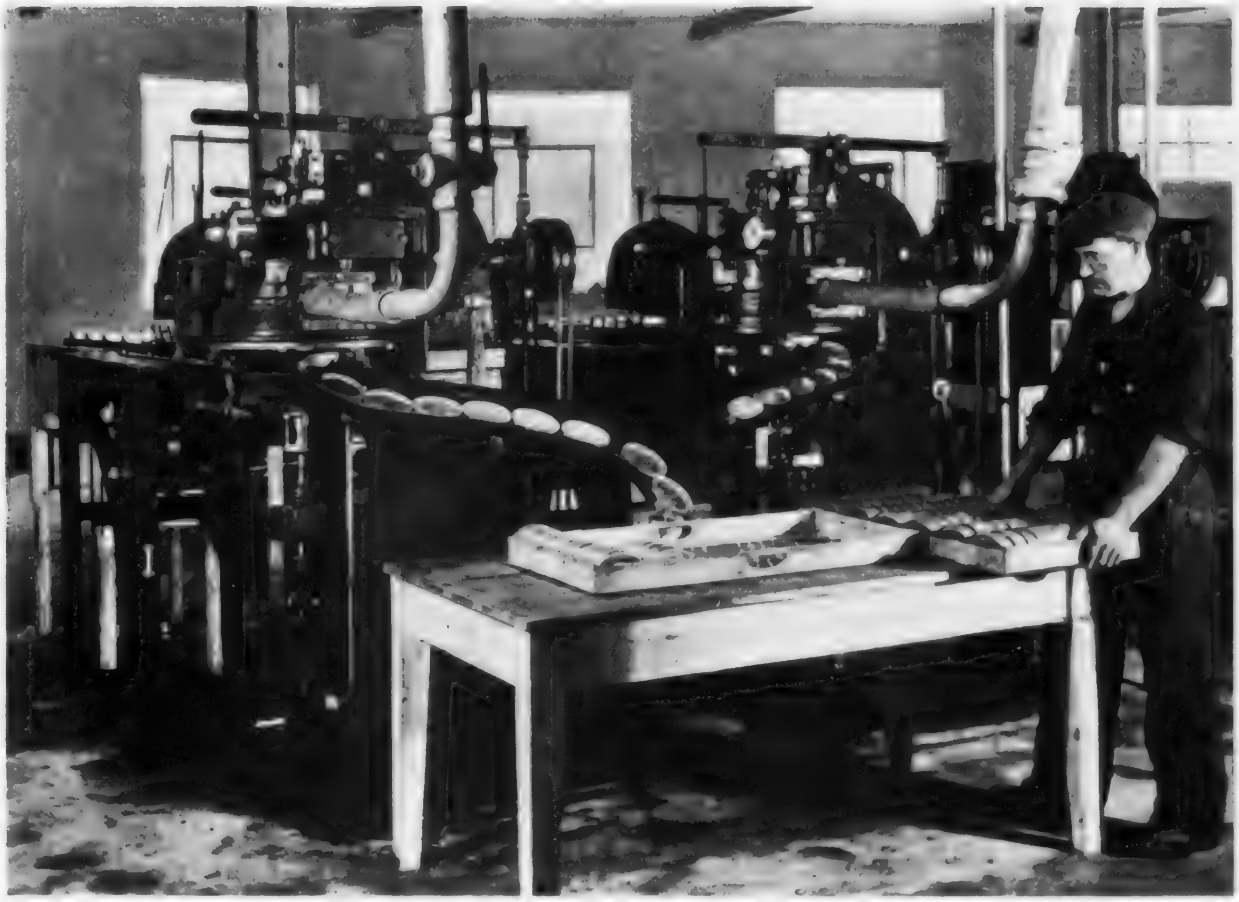
1. The presence of a single large oil globule at the hinder end of the yolk.

2. A large space between the membrane and the yolk (termed the perivitellin space).

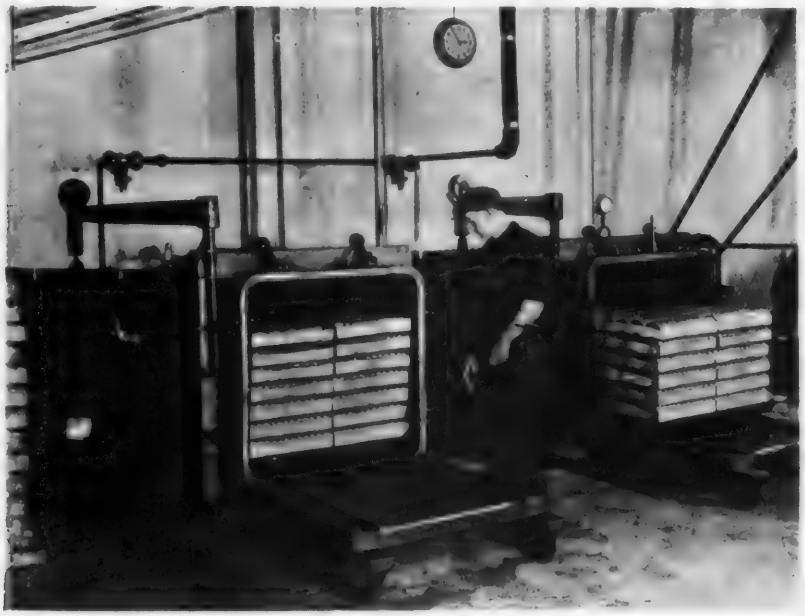
3. Complete division of the yolk into a number of irregularly shaped segments.

After fertilisation by the milt extruded by the male fish the eggs separate and float up to the surface of the sea, where development usually takes place rapidly. This, however, is dependent to some extent on the temperature and salinity of the water. The newly hatched slender transparent larva is about $\frac{1}{8}$ inch in length and has the unabsorbed yolk sac attached to the abdomen. The eyes are black and show slight yellow pigments; the gill slits are open, but show no gill covers. The mouth is not at first apparent, but on the third or fourth day the jaws develop and the yolk sac is absorbed. During this early period the larva is liable to be attacked by a host of enemies such as medusæ, arrow worms, and other predatory plankton organisms. On the fifth day the larva, which is about $\frac{1}{8}$ inch long, begins to feed, but the scales and fins do not develop until a length of $1\frac{3}{5}$ to 2 inches is reached, the dorsal fin being at first placed well back, but as the young fish grows it assumes its proper position. About this period there is also growth and thickness of

The Automatic Oiling machine, which places the correct quantity of oil in the tins.



The Automatic Vacuum Seamer where the tins are hermetically sealed at the rate of 40 per minute. Seamed tins are seen coming from the seamers.



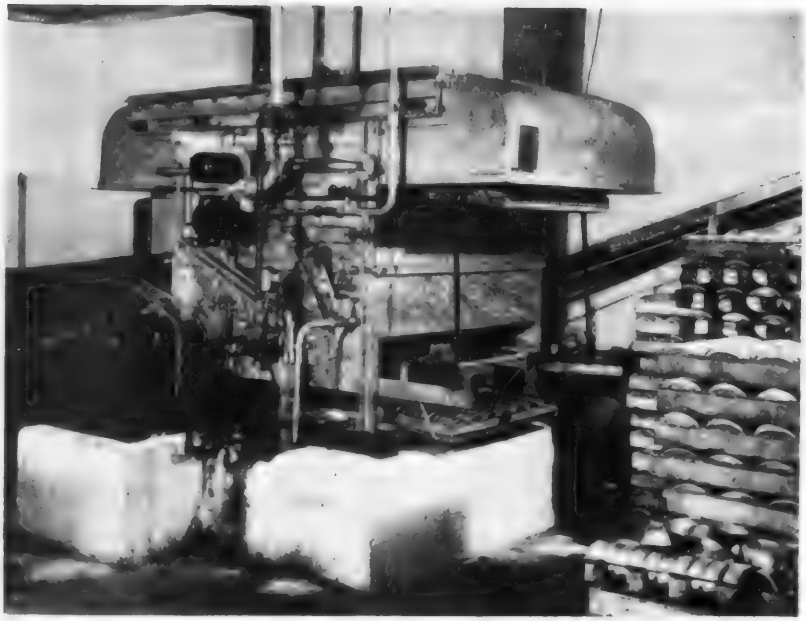
Processing is carried out in these two retorts, each of which holds 3,000 tins, at a temperature of 240° F. with 11 lb. pressure for about 35 minutes.

body, and a silvery sheen appears on the skin. The rate of growth varies considerably and is determined by the temperature of the water and the nature and abundance of food. A length of 1·2 to 1·6 inches in March grows to 4·7 or 5 inches by December, and at the end of a year it is 6 inches and in two years $7\frac{1}{4}$ inches long. Pilchards $8\frac{1}{2}$ to $9\frac{3}{4}$ inches in length are about four years old. Spawning usually takes place at the age of three years.

Prolonged research has shown that the age of the pilchard can be accurately determined by certain markings (zones and rings) on the scales, in much the same way as the annual rings in the trunk indicate the age of a tree.

THE MODERN METHOD OF CURING AND CANNING

The canning industry is in full swing at Mevagissey from June to October,



After the tins are cooled they are passed through the De-greasing machine, shown here, which dries, cleans and delivers them on to a conveyor.

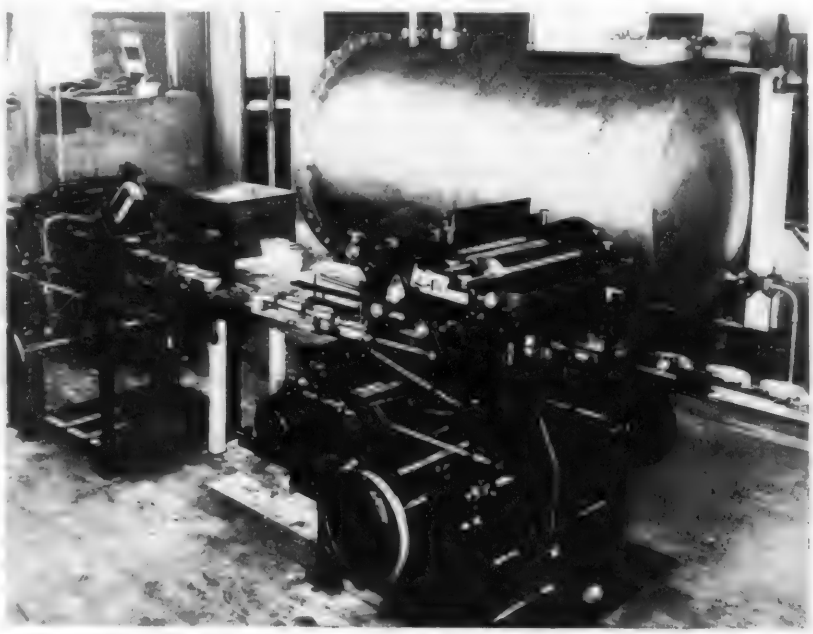
when the fish are in first-class condition. The drifters, which usually return from fishing in the early morning, are met by the quay staff from the factory. The catch is unloaded and counted into baskets, each holding about 300 fish and transported to the cannery cleansing room, where they are gutted and headed. Speed and careful handling are necessary, as pilchards, being rich in oil, soon crush and spoil. The process is carried out by women, and it is amazing to watch their skill in wielding a sharp knife to split and gut the fish almost at a single stroke. One woman will eviscerate forty to fifty in a minute. They are then thoroughly washed and transferred to the brine tanks, each of which is 4 feet in diameter and holds about 500 fish. The density of the brine (80 to 100 per cent. saturated solution of fishing salt) and time of immersion are carefully checked, as under- or over-salting greatly influences the flavour of the finished article. The fishing salt used must be coarse grained and free from impurities, such as sulphates and chlorides of calcium and magnesium.

On removal from the brine tanks the fish are drained and suspended from hooks attached to wooden bars. They are then placed on racks one above the other in the smoke room. The smoke is made by smouldering oak turnings and sawdust. This treatment lowers the moisture content to approximately 10 per cent. and imparts a delicious flavour to the pilchards. After smoking they are packed in wire baskets holding 120 to 130 medium sized fish and placed in the frying bath. This is constructed of stainless steel and the oil heated by the Marilene patent heater, the temperature, usually 120° to 130° F., being thermostatically controlled. By operating a handwheel the time taken in frying can be varied from 3 to 8 minutes, and approximately ten to eleven thousand fish are dealt with in one hour.

The finest grade of olive oil is used in the process of frying, and this is clarified and freed from impurities by being continuously passed through a centrifugal machine attached to the apparatus.

After frying is completed the baskets are removed and placed on special racks fitted with drip trays, to drain and cool until the following day, when the tail of each fish is removed and a cut to the required length made near the head end. The pilchards are then selected and put into tins by experienced women and delivered on to the packing tables through an automatic oiling machine. A conveyor then carries the tins—each of which contains 5 fish and 2 oz. of olive oil—to the vacuum seamers, where they are hermetically sealed at the rate of 40 per minute.

Processing is afterwards carried out in two retorts, each holding 3,000 tins, at a temperature of 240° F. with 11 lb. pressure, for about 35 minutes. The tins are cooled and passed through a de-greasing apparatus, which dries,



The Labelling machine. The machine on the left fixes the oval label and the one on the right the band label.

cleans, and delivers them to a conveyor and on to the store-room. A special machine then fixes the labels to the tops and sides of the tins at the rate of 40 a minute.

The finished product, which compares favourably with high-class sardines, weighs approximately 12 oz. gross and 9 oz. nett, and is retailed at 10d. a tin. When the factory is completed and fully working it will be capable of handling 12,000 tins daily.

THE FOLLOWING FIRMS WERE CONTRACTORS FOR PLANT, EQUIPMENT AND MATERIALS

Frier, heater, and control instruments	*The Kestner Evaporator and Engineering Co., Ltd.*
Cooling and draining racks	*James H. Randall and Son, Ltd.*
Vacuum seamers	*The Premier Filterpress Co.*
Labellers	*Verpackungs - Automaten, G.m.b.H., Düsseldorf.*
Retorts	*John Fraser and Son, Ltd.*
Oil purifiers	*Alfa-Laval Co., Ltd.*
De-greaser	*Imperial Chemical Industries, Ltd.*
Oil filling machine	*G. Hopkins and Sons (Clerkenwell), Ltd.*
Cans	*John Feaver, Ltd.*
Labels	*Brown and Rawcliffe, Ltd.*
Cartons	*Thames Board Mills, Ltd.*

Cartons of tins packed ready for delivery.

A NOVEL CLOSURE CAP

THE principle of selling a first-class product and also of inducing the consumer through an attractive pack has been more or less established for many years in all types of merchandise. Present-day domestic conditions and inclinations demand modern packs, and the modern trend also insists that up-to-date packs are effected by the use of handy closures, attractive from the display viewpoint.

As a result of this demand, a cap has appeared in the British market which is made from two shells, the outer being of plain design, thereby concealing the unattractive screw of the inner shell.

Recently a new cap of ingenious design has been introduced. It consists of a closure with the appearance of a double-shell cap, but manufactured out of a single piece of metal. This cap is appropriately named "Unishell" and is manufactured by British Duplex Seals, Ltd. Owing to its design, a high sealing efficiency is obtained, as the last part of the thread of the cap grips under the last thread of the container, thus imposing the cap tightly to the sealing surface. The weight of the cap is said to be about 40 per cent. lower than the double-shell type, thereby effecting a considerable saving in freight charges.

The diameter of the wads in this cap exceeds the distance between the edge of the threads across the cap, so that the wads can neither fall out nor adhere to the container when used for products of a sticky nature. Corrosion is impossible as the only edge on this cap is at the bottom of the thread and is turned right under with no raw metal exposed. Unishell caps are manufactured in plain, printed or fluted design in various colours.

The manufacturers of the Unishell cap have adopted a range of sizes for standard glass container necks developed by the American Glass Containers Association. The idea of standardising the necks of glass containers in this country, such as has already been effected years ago in other countries, would be an innovation which would be not only greatly appreciated by glass and cap manufacturers, but also by producers in every trade.

REPORTS RECEIVED

THE following reports have been received during the past month :

Seventeenth Annual Report of the Ministry of Health, 1935-36. The report is divided into four sections : Part A.—General. Part B.—Local Government. Part C.—National Health Insurance and Contributory Pensions. Part D.—Welsh Board of Health.

Report issued by the Medical Research Council on The Nutritive Value of Fruits, Vegetables, and Nuts by R. A. McCance, E. M. Widdowson, and L. R. B. Shackleton. The report is divided into three sections : Part I.—Analytical Methods. Part II.—The Composition of Plant Foods. Part III.—Changes in Chemical Composition brought about by Cooking.

Report for 1935 of the Rothamsted Experimental Station, Harpenden. The range of investigations includes the growth and composition of crops, the properties of soils, of fertilisers and manures, soil management, plant diseases, insect pests, bees, and other subjects.

Report of the Director of Food Investigation for the year 1935. Section VI.—Canning.

Plantation Crops. A summary of production and trade relating to sugar, tea, coffee, cocoa, spices, tobacco, and rubber, compiled in the Intelligence Branch of the Imperial Economic Committee.

The PREVENTION of MOULD in FOODSTUFFS

By RALPH G. HARRY,
A.I.C., A.C.I.C., F.R.M.S.

Moulds developing from vegetable parchment (species of Penicillium).

THE ABILITY of moulds to exist at low temperatures and to grow in media of low *p*H or high osmotic pressure makes them important agents in food spoilage. The frequency of mould spores in ordinary air is best exemplified by the experiments of Jensen and Orner.[1]

They exposed a plate of glucose agar for 48 hours and examined the colonies produced. These were found to contain the following "moulds":

Penicillium	37
Aspergillus	14
Mucor	18
Rhizopus	12
Torula	71
Yeasts	11

Moulds may thus be found in such products as smoked meats and hams, butter and cheese, pickles, sauces, fruit and vegetables. In fact, owing to their extraordinary abilities of adaption to prevailing conditions, there are few foods which can be said to be immune to their attack.

Toxicity of Moulds

At present there is little available evidence that mouldy food actually causes illness. Church and Buckley[2] have fed saprophytic species to animals without ill effects, and Dinwiddie[3] fed pure cultures of *Penicillium glaucum* to a colt without ill effect. Gortner and Blakeslee,[4] on the other hand, have reported the formation of a toxin by *Rhizopus nigricans*.

Too much reliance cannot always be placed on animal experiments, and too little is known of the physiological action of mould spores and their products to enable any definite opinion on this point to be given. The fact that moulds can synthesise such substances as oxalic acid should, however, be borne in mind. In any case it is certain that their presence in food products is serious, giving rise to "taints" on the one hand, and rendering the food unsaleable by its appearance on the other.

Certain mycodermæ which do not themselves hydrolyse fat may promote the formation of esters. According to the investigations of Fiertz-David,[5] moulds can oxidise free fatty acids to methyl ketones, giving rise to "ketone" rancidity.

Mould Prevention in the Commodity

Fortunately, moulds are readily destroyed by heat, and in this respect are even less resistant than bacteria. According to Lode,[6] dry heat at 125° C. killed all mould spores in 15 minutes, but they were not destroyed by heating at 80° C. in 7 hours.

Thom and Ayers,[7] however, found *Rhizopus* and *Oidum lactis* to be destroyed in the pasteurisation of milk (30 minutes at 54·5° C.), but that most strains of aspergillus and penicillium required 60° C. for 30 minutes.

Roderick[8] found that moulds in sausages were killed when heated in water for 10 minutes at a temperature of 60° C.

Apparently a temperature of 60° C. for 30 minutes, or 65° C. for 15 minutes, is sufficient to destroy the majority of moulds.

In the manufacture of foodstuffs involving cooking the destruction of mould is relatively simple. The danger, however, lies in the prevention of subsequent infection on storing, packing, etc. Even where pasteurisation has been employed (such as in the manufacture of pasteurised butter and cream), the danger of subsequent infection remains, since mould spores have been shown to be ubiquitous.

Mould Prevention in the Factory

Many premises become infected with spores of mould, perhaps through a leaking roof, or through dust, or by

the storage of products likely to encourage such growth, and in such case the factory itself becomes a harbourer of infection.

This must never be allowed to occur, and, whilst a daily clean is, of course, essential in any factory, this is not necessarily efficient. I suggest, therefore, the following method of dealing with this problem.

The factory should, wherever possible, be so designed that the raw material enters at one end and the finished product leaves at the other. Raw materials are nearly always heavily contaminated *en route*, either with mould spores, fæcal matters, or both. These should be stored in an entirely separate portion of the factory, and employees handling the finished product should not have access to such stores unless suitable cleansing precautions are taken.

In the construction of the necessary buildings the use of wood should be avoided. Moulds readily grow on it when damp, and it is quite impossible to keep the surface really clean. Moreover, Shunina[9] has shown that in the case of wooden butter churns not only does the open surface of the wood offer protection to the spores, but it has in itself a stimulating action on the mould.

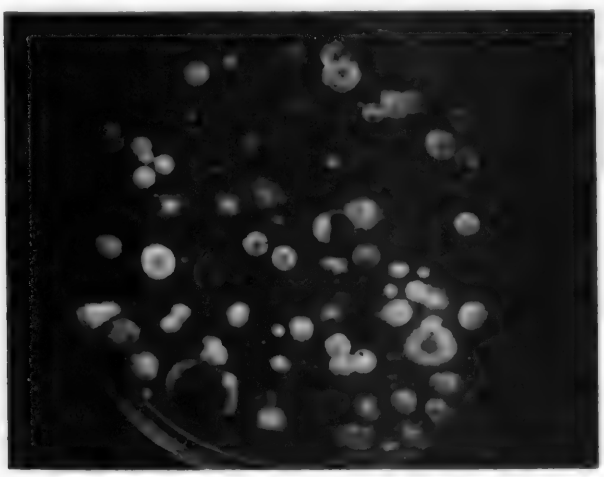
Walls and ceilings should be so constructed that they are impervious to moisture and readily cleansed, and tiles, glass, and stainless steel may be used in place of the more usual materials.

In any process involving steam, adequate and efficient ventilation should be provided and precautions taken to keep the humidity of the air as low as possible. Mould formation is assisted by high humidity; moreover, the condensation of such steam will invariably lead to contamination.

Benches and utensils should preferably be of some such material as stainless steel or glass, and where moving belts are employed these should be constructed either of suitably treated leather or of some impervious material. The ordinary canvas belt is far too absorbent to be satisfactory.

Cleansing and Disinfection of Premises

The action of the various disinfectants on mould spores might well be further investigated, and publications dealing with this are somewhat scanty. Lode reports that mould spores are killed by 0·2 per cent. solutions of mercuric chloride, 5 per cent. solutions of phenol, and 3 per cent. chloride of lime. The new esters of p-hydroxy benzoic acid are non-toxic and extremely active against mould growth. Possibilities are also shown by p-chlor-meta-cresol. Investigations which I have conducted recently show that this substance, which is considerably cheaper than benzoic acid esters, is very efficient against aspergillus and penicillium infection, in concentrations of 0·1 per cent.



Moulds developing in Beer Wort Agar media after 48 hours exposure to the air.

One of the safest and most widely used disinfectants for this purpose is sodium hypochlorite. Since it is easily oxidised by all organic matter, it is imperative that all visible grease and dirt should first be removed by a preliminary washing with hot water and soda or, where this is impracticable, with hot soapy water. Sodium hypochlorite is obtainable containing 13 to 15 parts chlorine, and for general work this should be diluted and used at approximately 1 per cent. strength. Walls may be sprayed and table tops swabbed. Besides being a good germicide, it is an agreeable deodorant.

The manufacturing plant itself and its attendant equipment should be steam hosed with live steam. For small articles a low-pressure autoclave might be used; for large articles a special room into which steam can be introduced under a moderately low pressure would probably be most satisfactory.

Mould Growth on Painted Surfaces

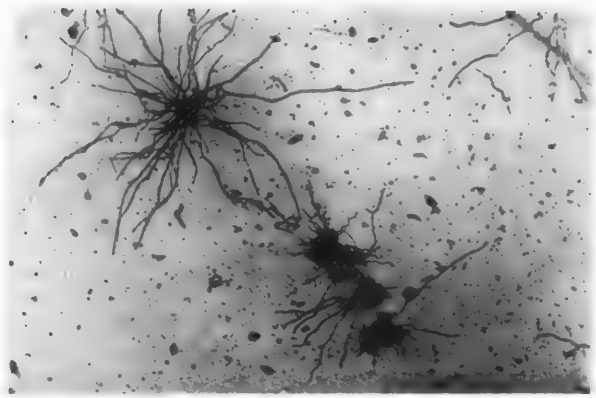
In bakeries and certain food factories, where high temperatures and humidity occur together, mould growth may occasionally occur on painted surfaces, either in the factory itself or in subsidiary storerooms, particularly when those surfaces are based upon a wooden or plaster ground.

A recent investigation ("Mould Growth on Paint Films and its Prevention," R. G. Harry, *Paint Manufacture*, October, 1936, 309) has brought to light several interesting facts which may be of service to the food manufacturer desirous of preventing the possibility of such attack.

It is probable that the majority of the fungi classed as aspergillus, penicillium and fusarium are capable of growing on painted surfaces under suitable conditions, and although under normal conditions the undercoating may be responsible for such attack, it has now been demonstrated that growth *can* take place on the *surface* of the paint (or distemper) *itself*.

As a result of experiments carried out to determine the efficiency of certain fungicides, only two gave promise of value (with the exception of mercuric chloride, which was considered too poisonous for general use). These were thymol, used in the proportion of about 0·8 per cent., and parachlormetacresol 0·3 per cent., and for reasons given in the original paper the latter was considered preferable. Its reasonable price and low toxicity make this substance of extreme interest in the surface sterilisation of articles in use by food manufacturers.

The pigment of the paint itself exerts an action upon the growth of mould spores. Titanium and lead are not fungicidal, but zinc exerts marked inhibition of growth, probably due to the formation of a soluble salt of zinc



Penicillium expansum developing upon titanium paint.

having a direct fungicidal value and also to the hardening effect which it exerts on the paint films itself, preventing the secure adhesion of spores.

Preventive Measures.—It is essential that all groundwork (plaster, old paint, etc.) should be free from mould spores, and, where present, the most effective cure is hot steam. In cases where this is impracticable the groundwork should be painted with a 10 per cent. solution of parachlormetacresol in methylated spirit, by which means the parachlormetacresol is deposited in the pores of the plaster or other substance, and on exposure of this surface to high humidity some of the salt passes into solution, thus maintaining the sterility of the surface. For washing painted surfaces, tiled surfaces, etc., an aqueous 0·2 per cent. solution of the above makes an excellent germicidal wash. Having obtained a reasonably sterile base the next consideration is the paint.

This should contain, wherever possible, a fair proportion of zinc oxide, since this assists in inhibiting mould growth. The addition of a good varnish also assists in hardening the paint film and assisting drying and non-adhesion of fungal spores. Further, it is a wise precaution to add sufficient parachlormetacresol to maintain a concentration of 0·3 to 0·4 per cent. in the finished paint. (To secure a concentration of 0·4 per cent. add 1 oz. of this substance to every 16 lb. paint.) The best results are obtained with the maximum of pigment and the minimum of binder consistent with the production of a good paint.

Air-Conditioning

Although air-conditioning is expensive, it is an excellent investment where perishable goods are concerned. It is useless to take all these precautions if the air in the factory is already heavily contaminated with mould spores, dust, and bacteria. Moreover, the use of such equipment means that the temperature and humidity of the factory may be controlled all the year through.

The Water Supply

All water used should be chemically pure and free from objectionable substances. In addition, it should either have been recently boiled or kept at a temperature of 70° C. for 15 to 20 minutes.

The Prevention of Mould by Packing Material

Arup[10] has investigated mould growth in vegetable parchment used for packing dairy products. All the samples examined were capable of sustaining mould growth, and he showed that a connection existed between the extract content of a parchment and its power of supporting mould growth.

The development of a species of penicillium from commercial vegetable parchment is shown in the accompanying photograph.

In the regulations dealing with vegetable parchment, issued by the Department of Agriculture (Dublin), "the paper cut to the requisite size must, the night before it is used, be placed in some approved vessel containing a *saturated boiling solution of brine and allowed to remain overnight*".

It is highly desirable that whatever packing materials are used should be free from sugars, glycerin, and other fermentable substances.

Personal Hygiene

In order to co-ordinate these methods of preventing infection by micro-organisms, the assistance of the employees should be enlisted. Every person engaged in the manufacture of food should wash their hands on arrival immediately before commencing work and always after the use of the cloakroom. White aprons (provided by the employer) should always be worn, and these should never be allowed to be taken from the premises. An adequate supply of clean coats, etc., should be provided, as soiled clothing is an excellent media for putrefactive and objectionable micro-organisms.

Examination for Mould Growth

No method of mould prevention can be considered to be complete unless it includes a frequent periodical examination of the product to ensure freedom from mould growth and spores.

Viehoever[11] has suggested a laboratory method which can be used for detecting their presence—

By Culture.—Specimens of the food are inoculated into solid media and incubated to allow germination of the mould spores or vegetation of the hyphæ. This method is only applicable to those foods which contain living moulds or spores, and cannot be applied to foods prepared over a long period. Still, it is of value in determining the probable behaviour of the food in question on storage.

I prefer to cultivate on beer wort agar or glucose agar, plates being prepared in duplicate and incubated in an atmosphere saturated with moisture, one at 20° C. and the other at 37° C., since some species develop only at the lower temperature, whilst certain strains (some forms of aspergillus, etc.) are favoured by incubation at blood heat.

Direct Microscopic Examination.—A portion of the material may be examined in a hanging drop between a cover glass and a slide. In this method the detection of moulds rests upon the absence of extreme decomposition. Howard's method for the control of tomato products is an example of the practical use of this method. Alterna-

(*Continued on page* 403.)

Quality Requirements for CANNING CUCUMBERS

By Dr. D. J. TILGNER of WARSAW

THE SUCCESS of the canning industry depends in each country mainly from the quality and the price of the raw product. A uniform and high quality, together with an abundant supply of the raw products, is of primary importance for the favourable development of the industry, which may thus turn into a large and reliable outlet for easily perishable goods. The necessary co-operation of the producer and the manufacturer should be based upon liberal quality requirements, established for each particular canning product. The producer is expected to know what kind of the raw product is considered by the respective industry as the most suitable for manufacturing purposes, though the canner is not always in a position to give a final answer to this question. Well-managed canneries purchase the raw materials in strict conformity with their specifications.

When compared with the production of fermented dill-pickles, the canning of cucumbers is far less risky for the manufacturer. With the latter there exists practically no danger of spoilage, which may be accounted for by the softening of the finished product or its slippery surface, as is the case with dill-pickles. The investigations carried on during the last fifteen years show for this reason an average loss of 40 to 50 per cent., and always over 10 per cent. of each dill-pickle stock. This particular superiority of the canned cucumber over the dill-pickle accounts for the steady increase of its production, especially since the canned cucumber conserves, moreover, the crisp succulence of the fresh product and has a mild aromatic flavour. These factors, as well as the methods of production employed in Poland, were described already at an earlier date.[1]

Quality Requirements

Without discussing the details[2] it must be pointed out that cucumbers for canning purposes should be regularly and cylindrically shaped, firm fleshed, possess a uniform deep green shade and small seeds only. The surface of the cucumber should be either partially warty or entirely smooth and show no dark spots nor cuttings whatsoever. The length of the cucumber should be at least 8 cm. and not over 11 cm., with a maximum diameter of 5 cm. Two factory sizes are observed—viz., 8 to 10 cm. and 9 to 11 cm. The quality requirements for canning cucumbers in Poland have been worked out at the Standardisation Bureau of the Association of the Polish Chambers of Commerce and Industry. These requirements are obligatory in Poland.

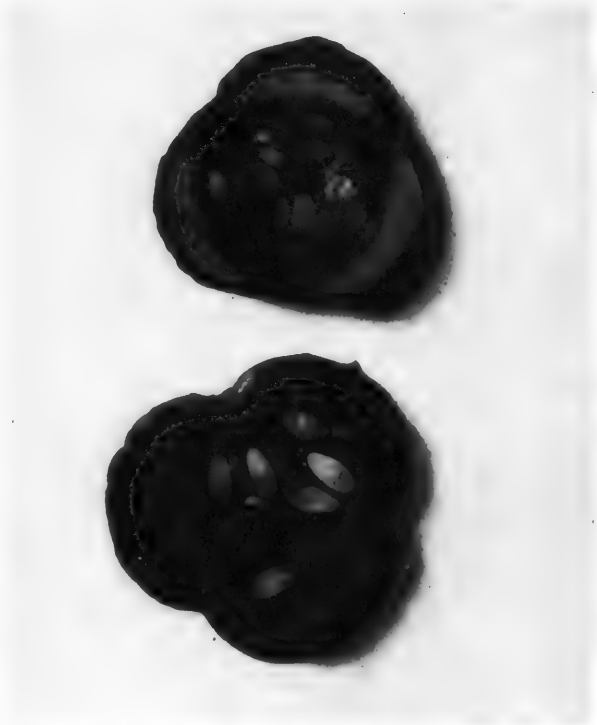
Varieties

Experiments carried out with different varieties showed that the Polish variety "Monasterskie" has good qualities with regard to the size of crop, resistance, etc. It may provide a good material for further selection. Two other Polish varieties, "Przybyszewskid" and "Nieżyńskie", although extensively used for dill-pickles in barrels, do not give good results in canning, as they are rather un-

Cucumbers for canning should be regular and cylindrical in shape, 8-11 cm. long and show no spots or injuries.

Cucumbers of unsuitable variety or too young show either before or after the canning process hollow canals, which make the product unmerchantable.

Even very small spots on the surface of the raw product develop into dark discolourations as shown. Such products are disqualified by the official standardization control.



Cucumbers for canning should be young and possess small seeds only. The lower of the two cross sections shows an unsuitable specimen with too large seeds.

even in shape and cause difficulties in sorting the crop. The American variety, Snow's Perfection, shows under Polish conditions a very small resistance, though the crop is uniform in size and shape.

Commercial Seeds

In order to develop such a type of cucumber for canning purposes which would be shapely, prolific, and as near disease-resistant as possible, it is essential to carry on a rigid seed selection. In most cases no one knows what type of cucumber will grow from the seed planted, irrespective of the name under which it was sold.

Only plants producing perfect cucumbers may be used for seed. Weak plants, as well as plants not true to type, should be destroyed and removed from the field. Only such procedure can secure a strong and reliable strain for canning.

Pectins and Firmness

According to our observation, the firmness of the canned cucumber depends mainly from the pectin content of the raw product, and varies with the age and variety of the cucumber, being also influenced by climatic conditions during the growing season, whereas the kind and amount of fertilisers is of minor importance.[3] When canning very young and early cucumbers the finished product shows invariably hollow canals due to the presence of soluble pectin substances, though this observation needs further chemical investigation. Rahn[4] also points out that pectin substances play an important role in cucumbers. The architecture of the cucumber is therefore an important thing for the manufacturer to know and to continue studying.

Yield of Cucumbers

During our investigations and numerous quality controls of canning plants in 1933-36 we have found that the size of the crop is greatly influenced by the temperature prevailing during the growing season which lasts from May until the middle of September. In the average the yield amounts to 15,000 kg. per ha., which refers only to canning cucumbers fulfilling the above-mentioned quality requirements. Crops of 25,000 kg. per ha. were also observed, giving the grower a gross return of 1,250 zł. /zł. 28 - Ll. . . as compared with zł. 250 obtained from growing rye.

[1] Tilgner, *Food Manufacture*, ix, 11, 1934.
[2] Tilgner, *Polish Agricultural Annual*, xxxvi, 2, 1936, Poznań.
[3] Nicolaisen N i Nolte, Prof. Dr., Mitt., DLG, 18, 1933, 384.
[4] Rahn, O., *Canner*, 81-82, 1935, Chicago.

MILK CONCENTRATES

THE second part of the article by Dr. C. Knoch on Milk Concentrates has had to be omitted from this issue owing to pressure of space. It will appear in our December issue.

BOOK REVIEWS

Colorimetric Analysis

Since the appearance of the first edition of this work in 1921 so much progress has been achieved in this direction that it has been necessary to produce a second edition, which is divided into two volumes. The first, which is reviewed here, deals with inorganic systems, while in the second matters appertaining to organic, biological, and problems incapable of exact classification are discussed.

The first nine chapters deal with the general applicability of colorimetric methods, the different forms of apparatus which are required in the carrying out of these estimations, the accuracy which can be attained, and the artificial standards which can be employed for comparison; a chapter dealing with the necessary calculations is also included.

The chapters which then follow cover in a minute and comprehensive survey almost every element in the periodic table—C, Carbon Monoxide, Carbon Dioxide, CN, O, Hydrogen Peroxide and Ozone, Cu, Cd, Hg, Pb, Th, Bi, As, Sb, Sn, Al, Cr, Fe, Ni, Co, Mn, Zn, Ti and Ce, Va, W, Mo and Rb, V, Be, Au, Ag, Pt, Rh, Ir, Pd, Na, K, Li, Ca, Ba, Mg, P, Si, Bo, Cl, Chlorine and Chloramines, Br, I, F, Chlorates and Perchlorates, Sulphides, Se, Te, Thiocyanates, Sulphites and Sulphates, Nitrates, Nitrites, and Ammonia; this brings us to chapter lxiii.

The remaining four chapters are devoted to a minute review of the position concerning hydrogen ion concentration, the theoretical and practical aspects of the problem being dealt with. Each section of a chapter is divided thus: *Sample:* Source and method of treatment; *Determination:* The different methods in which the element under consideration can be isolated; *Reagents:* The reagents to be employed are indicated; the *Procedure* is detailed and the *Standards* for comparison are laid down. Thirty-seven tables and 109 illustrations are given, together with some 2,000 references, while an author and subject index completes this most valuable contribution to the subject. C. I. B. V.

Colorimetric Methods of Analysis. Snell and Snell. Chapman and Hall, Ltd., London. 2nd ed., 1936 *(2 vols.); vol. i, pp.* 766. *Price* 45*s.*

Biochemistry

The herculean task of reviewing a single year's progress in Biochemistry may be realised from the fact that the work of some 4,000 investigators is reviewed in this volume, while due apologies are made to those whose publications, through considerations of space, have had to be neglected.

The editorial committee have adopted the wise plan of enlisting a completely new set of contributors to the present volume. While their qualifications may not necessarily be superior to those whom they have succeeded, the change is to be heartily commended. Not only is the onerous duty of compounding the reviews more equitably distributed, but the danger, however unintentional, of the continued over-emphasis of any particular line of investigation by a single reviewer is ruled out. The changes in authorship have been accompanied in many cases by changes in the subject-matter reviewed. Thus in the present volume chapters on "X-ray Studies of the Structure of Compounds of Biological Interest", "Mineral Metabolism", "Clinical Applications of Biochemistry", "Liver and Bile", "Comparative Biochemistry of Vertebrates and Invertebrates", "Animal Pigments", "The Biochemistry of the Nitrogenous Constituents of Green Plants", "Soil Microbiology", and "The Biochemistry of Fungi" have displaced a similar number of chapters on other equally important subjects, the discussion of which will no doubt be resumed in later volumes. There are also several other minor alterations in the titles of chapters, while the subject of "Vitamins" has been subdivided into "The Water-Soluble Vitamins" and "The Fat-Soluble Vitamins".

Under these circumstances it is clear that the aim of the editors is not so much to present a comprehensive summary of progress in the whole field of biochemistry, strictly confined to the year under review, but to "synthesise the material into a readable survey". It is perhaps a minor criticism of this system that papers having points of interest in more or less closely related fields should sometimes be dealt with several times by different reviewers. The general feelings of the reader desirous of obtaining the gist of current research in biochemistry in mentally digestible form must be of gratitude, both to the editors and to the contributors whose labours make the compilation of the volume possible.

The food chemist will doubtless be specially interested in chapters on "Nutrition" by A. H. Smith, "The Acyclic Constituents of Natural Oils and Fats" by T. P. Hilditch, "The Water-Soluble Vitamins" by H. v. Euler, and "The Fat-Soluble Vitamins" by E. V. McCollum. The last-named chapter contains an excellent account of the recent experiments leading to the adoption of carotene as the international standard of vitamin A. T. M.

Annual Review of Biochemistry. Vol. v, 1936. *Edited by James Murray Luck and a small committee. Published by the Stanford University Press, U.S.A. Price* $5.00. *English agents, H. K. Lewis and Co., Ltd., London.*

PREVENTION OF MOULD IN FOODSTUFFS

(Continued from page 400.)

tively, stained preparations may be made directly on a slide. Moulds are not easily moistened by water, owing to the presence on their surface of a thin layer of fat. This may be removed by treating with a little ammoniated alcohol, or by a little alcohol and ether, after which they may be stained as desired. Loeffler's methylene blue stains the filaments of the mycelium and hyphæ, the spores usually remaining unstained. In certain cases (such as the examination of plum jam, etc.) it is difficult to differentiate mould spores from certain elements of other cells. In such cases "Gram's method" of staining may be used. Yeast cells and most spores retain Gram's stain, while the round chromoplasts of the pulp cells do not.

In a third method use is made of the fact that certain fungi possess a substance of complex structure, termed "chitin". The material to be examined is heated to boiling with 40 to 50 per cent. NaOH for about an hour, neutralised with a little acid, and washed free from alkali, etc., with glycerol, and the mixture treated with a solution containing 2 parts iodine and 1 part potassium iodide in 200 parts water. The excess iodine is replaced with 1 per cent. sulphuric acid. Chitin is indicated by a violet or red colour.

In conclusion, I have endeavoured to enumerate the various ways in which infection may occur and the steps which I consider should be taken to preserve foodstuffs from subsequent spoilage.

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INDUSTRIAL NEWS

Foodstuffs in Raw Materials Conference

W. S. Morrison, Financial Secretary to the Treasury, spoke for Great Britain at the Second Committee of the League Assembly on October 5. The Committee met to consider the recent report of the League's Economic Committee on the whole subject of monetary policy and the removal of trade barriers. He said that the first difficulty was to decide what are the commodities to come under the name of raw materials. It might seem appropriate to include not only raw materials of industry but also certain foodstuffs. The enquiry might be usefully begun by making a definite list of specified commodities which should form the basis for the investigation, he suggested.

New Factories

The Board of Trade has issued a survey of industrial development which shows that 510 new factories, employing 49,750 people, were established in 1935, that there were 192 factory extensions, and that 486 factories were closed. The majority of the new undertakings employ between 25 and 100 workpeople, and the average over the whole field is 98. In the food, drink, and tobacco group 43 new factories were established, there were 14 extensions and 24 factories closed.

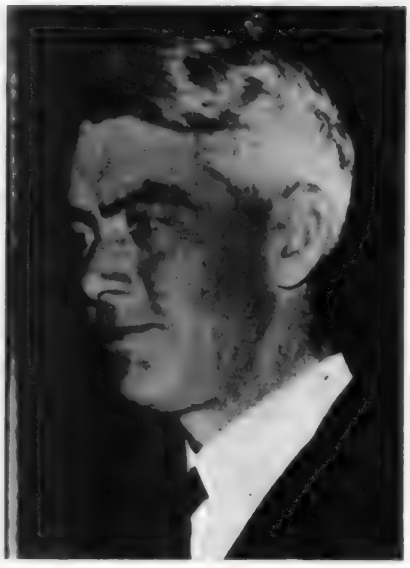
New Factory for Chocolate Company

The Associated Chocolate and Confectionery Co., Ltd., the premises of which were recently destroyed by a fire which was responsible for £120,000 worth of damage, have been preparing all their ordinary lines in a temporary building. Work is to start at once on the erection of a new factory at Inchicore Road, Dublin, on the site of the old factory.

National Dairy and Ice-Cream Convention

The exhibition plan of the National Dairy and Ice-Cream Convention at the Crystal Palace next January (January 26-29, 1937) has now been issued and shows that nearly 10,000 sq. ft. increased space over last year has been made available. This means that the exhibition is expected to be one-fifth as large again as it was last January.

The actual figures for comparison are 50,226 sq. ft. of exhibition space at the January, 1936, Convention and 59,598 sq. ft. available according to the new plan.



Mr. W. S. Morrison, Financial Secretary to the Treasury.

Import Duties Advisory Committee

The Import Duties Advisory Committee give notice of an application for an increase in the import duty on transparent cellulose wrapping.

The Committee also give notice that the offices of the Committee are now situated at Shell-Mex House, Strand, London, W.C. 2 (Temple Bar 7755).

Imperial Fruit Show and Canners' Exhibition

The Imperial Fruit Show and Canners' Exhibition will be held at the Renshaw Hall, Liverpool, from October 30 to November 7. The Show embraces every section of the fruit growing industry, as well as the canning of fruit and vegetables and the manufacturers of plant and equipment for these trades.

The Tenth Annual Canners' Convention, organised by the National Food Canning Council, will be held in Liverpool from November 3 to 5.

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Wild-Barfield Electric Furnaces, Ltd., have made arrangements to demonstrate their electric furnaces in co-operation with the Manchester Corporation Electricity Department in Manchester from October 27 to November 6 at the Demonstration Workshop, Dickinson Street.

Chemical Engineering

The courses of instruction in Chemical Engineering at the Sir John Cass Technical Institute were inaugurated on October 8 by an address on "The Profession of Chemical Engineering" delivered by Mr. W. A. S. Calder, F.I.C., M.I.Chem.E., Past President of the Institution of Chemical Engineers and Past President of the Society of Chemical Industry. Dr. H. Levinstein, M.Sc., Ph.D., F.I.C., President of the Institution of Chemical Engineers, was in the Chair.

Association of British Chemical Manufacturers

At the Council Meeting immediately following the Annual General Meeting on Thursday, October 8, 1936, Mr. E. Wallace was re-elected Chairman of the Association for the ensuing year. Mr. N. N. Holden was re-elected Vice-Chairman, and Mr. C. F. Merriam, Honorary Treasurer.

Bigger British Industries Fair

The Management Committee of the British Industries Fair have decided to extend the Fair buildings at Birmingham still further. The exhibiting area was increased by 27,000 sq. ft. for the 1936 Fair, and the present extension adds a further 12,000 sq. ft., bringing the total indoor exhibiting space to well over 300,000 sq. ft.

Leipzig International Fair

The "House of Nations" will be a new feature of the International Leipzig Fair. The administration of the Fair has just taken over a building in the city and has had it redecorated and named the "House of Nations". Until recently there were about 25 different foreign meeting places scattered all over Leipzig, which will now be united in the "House of Nations", where the foreign Fair buyers (more than 24,000 at the last Spring Fair) from all countries of the world will find comfort and any assistance they may need.

The Leipzig Spring Fair will take place from February 28 to March 5, and the Great Engineering Fair and the Building Fair to March 8, 1937.

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The eighteenth annual general meeting of the Chemical Club will be held in the smoking-room of the Club at 2, Whitehall Court, London, S.W. 1, at 8 p.m., November 3.

Founder of Horlick's Dies

The death of Mr. William Horlick, at the age of 91, occurred on Friday, September 25, at his home in Racine, Wisconsin, U.S.A. He was joint founder with his brother, the late Sir James Horlick, Bart., of the businesses bearing their name.

Death of Mr. J. W. Tilley

We regret to learn of the death of Mr. James W. Tilley, F.C.S. Mr. Tilley had spent many years in the service of Stevenson and Howell, Ltd., and was at the time of his retirement a joint managing director. His son is, and has been for some time, on the scientific staff of Stevenson and Howell, Ltd.

Forthcoming Lectures

November 3.—Symposium of papers and informal discussion on "Corrosion in the Refrigerating Industry". British Association of Refrigeration, at 6.30 p.m. Institute of Marine Engineers, 85-88, Minories, London, E.C. 3.

November 17.—Lecture, "The Control of Imported Food", by Dr. D. M. Connan, M.O.H., Borough of Bermondsey. At the Public Health Congress, Agricultural Hall, at 3 p.m. Professor J. W. H. Eyre, M.D., F.R.S.E., in the chair.

November 20.—Lecture, "Chemistry of Nutrition", by J. C. Drummond, D.Sc., F.I.C. The Chemical Society, at 6.30 p.m., in the Chemistry Lecture Theatre, Armstrong College, Newcastle.

November 26.—Lecture, "The Biological Breakdown of Carbohydrates", by Dr. H. A. Krebs. The Chemical Society, at 7 p.m., in the lecture theatre of the new Chemistry Building of the University, Leeds.

December 7.—Lecture, "Modern Developments in Insecticides", by Dr. F. Tattersfield and Dr. J. T. Martin. Society of Chemical Industry joint meeting with Food Group, at Burlington House, at 8 p.m.

December 8.—Symposium of papers and informal discussion on "Moulds, Bacteria, and Taint in Refrigerated Produce". British Association of Refrigeration, at 6.30 p.m. British Industries House, London, W.

Henry Wiggin and Co., Ltd.

The centenary of Henry Wiggin and Co., Ltd., which was celebrated last year, has provided an appropriate occasion for the production of a record of the company's interesting and eventful history. The history of the Wiggin business, so far as the nineteenth century is concerned, is practically the history of the nickel industry in England. The technical work of the early members of the organisation contributed materially to the development of what is now becoming one of the most important branches of industrial metallurgy.

The firm was founded in Birmingham by Brooke Evans and Charles Askin in the year 1835. The book traces its development from that date to the present day, and includes a fairly complete summary of the methods of refining nickel and cobalt as ultimately worked out and brought to success.

The book is exceedingly well produced, and contains a number of pictures of personalities who helped to build up the company, together with illustrations of various departments in the works.

Sir George Seaton Buchanan died on Sunday, October 11, at the age of 67. From 1906 to 1911 he was Chief Inspector of Foods, and he played an important part in the introduction of safeguards that are now in operation.

Mr. J. C. Goff, who has recently resigned from the board of Crosse and Blackwell, Ltd. He was chairman and managing director from 1928 to 1932, but in 1932 gave up the former position because of his growing duties as managing director.

The Hearson Milk Grader

In the October issue of FOOD MANUFACTURE an article by Ralph G. Harry, A.I.C., A.C.I.C., F.R.M.S., dealt with "The Methylene Blue Reduction Test in the Control of Milk Supplies". Chas. Hearson and Co., Ltd., 68, Willow Walk, Bermondsey, London, S.E. 1, make apparatus for carrying out this test which is entirely automatic, the temperature being controlled by means of the Hearson patent thermostat. The apparatus consists of an automatically temperature-controlled water bath made in hard rolled polished copper, racks having each hole numbered for identification purposes, graduated tubes to receive the samples of milk to be tested, methylene blue in tablet form used as an indicator and which only requires to be dissolved in water, mineral oil to prevent access of air to the milk while undergoing the test, and 1 c.c. pipette.

Stelcon Anchor Steel Plates

An independent company entitled Stelcon (Industrial Floors), Ltd., has recently been formed for the sale in Great Britain and overseas of Stelcon Anchor Steel Plates and Stelcon Steel-clad Flags. The address is Clifford's Inn, London, E.C. 4 (Holborn 2916). Mr. F. A. Langley and Mr. T. Kilburn are directors of the company and the staff has been recruited from Langley (London), Ltd.

A new folder has also been issued giving particulars of this type of flooring, which is made to withstand the heavy usage which flooring has to undergo in many factories and works. The booklet is well illustrated with pictures of Stelcon floors laid down in different types of works, including breweries, dairies, chocolate works, bakeries, etc.

"Impulsor" Open New City Showrooms

New city offices and showrooms have been opened by the Improved Emulsification Process Co., Ltd., suppliers of Impulsor Emulsifiers. The new address is 28, Chiswell Street, E.C. 1, and the new telephone number is National 6272.

It is anticipated that for personal enquiries clients will find this central address more convenient than the company's registered office at Greenford. Manufacturers interested in modern emulsification equipment may now view the latest Impulsor models at this accessible showroom, and discuss their problems with an experienced technical staff.

One of four 50-ton evaporators made by G. A. Harvey and Co. (London), Ltd., of Woolwich Road, London, S.E. 7, for the new sugar refinery of Tate and Lyle, Ltd., at Silvertown. These evaporators are of particular interest as they are claimed to be the largest welded pressure vessels so far made to Lloyd's Class 1 Code. In the picture the evaporator is undergoing heat treatment of one of the circular seams.

Carton Filling and Sealing Machine

The "Neverstop" carton filling and sealing machine built by Stokes and Smith Co., 23, Goswell Road, London, E.C. 1, is an adjustable machine capable of a large output, yet with slow mechanical movement. It is suitable for the packaging of many kinds of materials.

When the cartons are hand fed it deals with them at a speed of between 50 and 80 a minute, while with automatic feed the machine does up to 120 packages a minute. The machine automatically closes and seals the bottoms, fills the carton with the measured or weighed quantity of material, closes the carton, and after pressing the closed ends, delivers the package tightly sealed and ready to pack into the shipping case.

General Service Mixer

A bench-type model of this general service mixer, complete with ¼ h.p. motor and a bowl capacity of 12½ quarts, is being supplied by the Peerless Electrical Manufacturing Co., Ltd. The machine is fitted with a 3-speed gear-box and finger-tip gear changing.

The mixer has a ready sale in the bakery and catering trades. The bowl, beater, and hook are supplied in Monel; advantages of this metal being that it possesses high strength and is hard, durable, and easily cleaned.

Rice Polishings Concentrate

Ryzamin-B consists of the concentrated and purified vitamin-containing fraction of rice polishings (recognised as a rich source of vitamin B), and has a potency of not less than 50 international units of vitamin B_1 per gramme. Thus it is possible to add to the diet an adequate supply of the anti-neuritic factor in a relatively small bulk. Doses of vitamin B, which could not be tolerated by many patients in the form of yeast concentrate, may thus be given with safety. Ryzamin-B is suggested primarily as a dietary reinforcement for patients of all ages, to stimulate appetite and promote utilisation of food; secondly, where there is anorexia and loss of weight as may occur after prolonged fevers and in chronic wasting diseases. The concentrate is of unquestionable value in cases where wholemeal bread is omitted from the diet.

Ryzamin-B is a clear, golden-brown, syrupy preparation quite palatable and readily taken by children. A consistently high vitamin B_1 potency is assured by biological test. The product is issued by Burroughs, Wellcome and Co. in collapsible metal tubes (with nozzle) of ½ oz., from which the desired quantity can be expressed. A special measuring spoon is issued with each tube.

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Rubery, Owen and Co., Ltd., Darlaston, South Staffs, has acquired the business of Henry Caton and Co. (1936), Ltd., Britannia Works, Paynes Lane, Coventry, as from September 7, 1936. Mr. Henry F. P. Caton is being retained as works manager.

The Coventry representatives of the company, Geo. Heritage Smart, Ltd., will shortly transfer their offices to the Britannia Works.

Improved Small Filling Machine

Recently the Automatic Weighing and Packing Co. have effected considerable improvements to their latest small filling machine, which came on the market about a year ago, both as regards driving control and also the mechanism for feeding material from the hopper. By the use of special epicyclic gear attached to the worm driving spindle, it is possible to drive the stirring apparatus at a slower speed than the feed worm. With this arrangement a far more regular feed and consequently more accurate discharge of the quantities of powder being filled are possible.

New Time Controller

A new Auto Control Timing Clock, known as the "Brypat" Time Controller, has recently been introduced on the market by F. Bryan and Paton, Ltd., of 29, Paternoster Row, London, E. C. 4.

These clocks are for use with machinery driven by an electric motor. They are connected to the motor and the hand set at whatever period of time the motor is required to run, and at the end of that time the clock automatically stops the motor.

The clocks are made from zero to 60 minutes or zero to 120 minutes, and can be made to carry up to 500 volts. They are cheap and efficient, and can be used where there is great vibration.

TRADE LITERATURE RECEIVED

Fleet Logic

A new publication, entitled *Fleet Logic*, and issued by Morris Motors, Ltd., is designed to assist transport executives in the economical running and maintenance of their travellers' or salesmen's cars. The brochure, which is attractively produced and printed, contains a wealth of information covering such vital matters as: An analysis of running expenses; service and choice of cars; contract and hire purchase buying; and car knowledge for representatives. Within its sixteen pages is the accumulated wisdom of four years' experience by the Morris Company in running a special department known as the Fleet Liaison Section.

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The address of Anker Bros. and Co., Ltd., is now New Bridge Street House, 30/34, New Bridge Street, London, E.C. 4. The works address remains as previously, Ilford, Essex.

Food Manufacturing Equipment

The Handbook on Food Manufacturing Equipment, which was originally issued part by part by Henry Wiggin and Co., Ltd., has now been made available in bound form and is obtainable free on request from that firm.

The publication is a comprehensive one, consisting of 90 pages, and is devoted to a detailed description, under alphabetical headings, of a large variety of subjects likely to interest manufacturers of food and food equipment. Thus, for example, typical entries under "S" deal with such representative subjects as salt, sauces, separating equipment, shellfish, soft fruits, stills, and strainers.

References are freely made to the appropriate materials for use where purity of product and resistance to corrosion are of importance. Reference is made in some sections to the new metal "Inconel", which is finding increasing uses in food processing equipment.

The volume is tastefully bound in blue cloth, and contains over a hundred photographs of plant and equipment. The book summarises the research and experience of the Technical Service Department of Henry Wiggin and Co. Ltd., and should prove invaluable to all those associated with the food industry.

Spiralflo Boilers

A brochure has recently been issued by Spanner Thimble Tube Boilers, Ltd., 9, Billiter Square, London, E.C. 3, dealing with Spiralflo Boilers. The folder deals with various types of Spiralflo boilers, including waste heat boilers designed for marine conditions, boilers and water heaters for central heating and domestic supply, incinerator boilers, etc., and contains a number of blue prints as well as a page of illustrations from Spiralflo installations.

Haarmann and Reimer

T. Harrison and Co., of Willesden, London, have sent us catalogues from Haarmann and Reimer, of Holzminden, Germany, containing among other prices those of highly concentrated aromas, aromas for alcoholic drinks, aromas for baker's products, basic materials for aromas, and dissolvents for aromas. They state that prices are subject to market fluctuations and calculated f.o.b. Hamburg.

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The September-October issue of the *Bi-Monthly Messenger*, issued by Callow Bros., Ltd., Yosa Flour Mills, Bute Street, Liverpool, contains interesting information on oven work, the aeration of scones, and the making of diabetic bread.

Welded Stainless Steel

We have received a catalogue dealing with welded stainless steel products from Thompson Bros. (Bilston), Ltd. The company have been fabricating and welding plate work for over 50 years, and for the last 15 years have devoted special attention to alloy welding—*i.e.*, stainless, nickel, Monel metal, heat-resisting steel, and mild steel.

The catalogue bears an illustration on each page, many of which are of interest to the food industry, and include road transport tanks, rail transport tanks, milk storage tanks, syrup process pans, jacketed boiling pans, chemical plant, etc.

Electro-Copyist

Details of the Ruthurstat electro-copyist are given in a leaflet published by the Ruthurstat Company. The instrument reproduces in black on white, or *vice versa*, copies of almost every kind of document, including signatures, diagrams, pages of catalogues, by electro-rays on sensitised paper. The Ruthurstat is not a camera nor is it cumbersome. It does not required a skilled operator or a dark room.

The new Auto Control Timing Clock, known as the "Brypat" Time Controller, recently introduced by F. Bryan and Paton, Ltd. A note on this clock appears on page 406.

Elevating Trucks

Herbert Morris, Ltd., Loughborough, England, have issued a new folder with their elevating truck with platforms and their stacker. The folder is well illustrated, showing various applications of these labour-saving devices in different industries.

Aluminium

An attractive booklet published by the British Aluminium Co., Ltd., describes the production, properties and applications of aluminium. The resistance which aluminium exhibits to corrosive influences is stressed and to many chemical substances it presents a surface which is almost glass-like in its resistance to attack. The corrosion resistance of aluminium is due to the formation of an adherent, impervious film of oxide on the surface and this film-forming property of aluminium is adopted for the protection against corrosion of other metals than the light alloys.

Electric Vibrating Screens

International Combustion, Ltd., have issued a revised catalogue of their Hum-mer electric vibrating screens. The machines handle wet, greasy, sticky or dry materials of any shape; water sprays being fitted to facilitate wet screening. The vibrators used require an alternating current supplied by a special low-frequency generator, motor generator or a metal rectifier, and the vibration is transmitted direct to the screen cloth and does not shake the whole machine. The supporting structure therefore need not be specially stiffened, and the plant can be totally enclosed. As the material comes into contact with the vibrating cloth, the coarse particles are forced up and away from the cloth and the finer particles are free to fall through. This stratification feature contributes to the efficient results obtained. The accuracy of the Hummer is due to the movement of the material at right angles to the screening surface. Accuracy is also aided by the adjustable angle of the screen, intensity of vibration, and the striking block action, a combination which produces a powerful thorough sorting action. The machines are available in open and enclosed types of various dimensions.

Sulzer Technical Review

The third issue of the *Technical Review*, issued by Sulzer Bros. (London), Ltd., 31, Bedford Square, London, W.C. 1, contains a leading article on the new self-priming water ring pumps of Sulzer design, which are made in two types for handling water and air. Sulzer Frigocentrals, which cover a refrigerating range from 12,000 to 240,000 B.T.U./L., are also dealt with. Concluding notes are given on the refrigerating plant in a large brewery in Athens and the heating and ventilating plant in the Palace of Justice, Ploesti, Rumania.

CANNED BREAD

A Potential National Asset

By E. B. BENNION, M.Sc., A.I.C.

IT WAS with great interest that a sample of canned bread was examined, and it is to be hoped that the publicity which has been given to the matter already will have brought forth many enquiries, and among them some from enterprising bakers who will see in it a new line with tremendous possibilities.

The sample submitted was, we understand, a purely experimental one, the aim being to show that bread so canned would be perfectly edible even after many months.

This sample was opened on October 14. It had been canned on July 27 and still possessed a pleasing aroma, but could not be considered in any way fresh. Staleness had not been retarded by the method of canning employed.

The bread would be considered about 2 to 3 days old, so that the normal condition of freshness had disappeared. The bread itself was perfectly palatable and quite suitable for toasting.

First of all, if the method of canning used in this case is the method contemplated it looks as though much more research should be carried out to see if the degree of freshness can be improved before any such product is marketed.

Secondly, the shape of the can may require modification. For this sample the cylindrical type of can was used, the dimensions being, length 7½ inches and diameter 4 inches. The bread to fit this can was baked in an enclosed circular pan so as to fit the tin. This shape of loaf is not very popular however.

The question of using a rectangular tin should be seriously considered. It may have been tried and rejected. It should not be dismissed too readily, however, for the sandwich loaf is a loaf of increasing popularity.

Avenues for Usage

Canned bread may prove a most important addition to reserve food supplies.

The Minister for Defence should consider the advisability of adopting the policy of supporting the canning of bread. We understand that experiments are being carried out and estimates prepared for portable oven units under the defence plan. *It would be far better to know that the bread itself was available and not having to be produced, probably after all normal services had been affected by air attack or otherwise.*

There is also the question of feeding troops on active service. All those who were in the Great War know of the difficulties of getting fresh bread in the lines, whereas tin foods—particularly bully beef—were there in superabundance. If ever another such occasion arose there should be available a 4-lb. can of bread to every can of beef at least.

Further, with ships on active service or under normal conditions where adequate quantities of fresh bread cannot be carried and no bakery is available, canned bread would be most valuable. The Board of Trade might be approached and interested in the matter so as to include it as standard addition for the victualling of ship's lifeboats, for the availability of fresh bread might prove very helpful in saving life.

For campers canned bread would have an immediate appeal. For those who live in the lonely and inaccessible places of the world it would form a most welcome addition. For those in tropical regions where fermentation cannot be carried out satisfactorily because of the non-availability of fresh yeast and the difficulties of using other forms of aeration, canned bread would provide a most palatable addition to the dietary.

The avenues for the consumption of such bread are already there. All that is needed is for the right article to be packed and each avenue explored.

Bread Quality

If canned bread is to be popularised it must be of the best quality produced specially for this purpose. It must contain fat at the rate of at least 3½ per cent. of the weight of flour—*i.e.*, 10 lb. per sack. It should contain some milk powder at the rate of 1½ per cent., and it should be made from top-grade flours only. The method of manufacture would need to be carefully considered. For example, some type of long sponge system might prove best, because of the greater moisture in the crumb and the keeping qualities of such bread which could be maintained in the canned product.

It would be fatal to can a type of bread which normally stales completely during the first 24 hours. The ordinary type of sponge system used in Scotland would hardly prove suitable because of the acid flavour of the finished bread which would not find universal approval.

The illustration in the heading shows one of the cans in which the bread was packed together with two portions of the loaf. It will be noticed that the crust has sunk in some places, but that the loaf has cut well revealing a firm texture. The experimental work in this country is being carried out by the Metal Box Company, Ltd.

Analytical Methods applied to CEREAL PRODUCTS

By T. H. Fairbrother, M.Sc., F.I.C.

In the third and concluding part of this article the author deals with Fat, Measurement of Gas Production, Brabender's Fermentograph, the Baking Value of Flour and General Analyses.

FAT

THE FAT is usually determined on middlings which may contain germy stock or on germ itself. The Fertilisers and Feeding Stuffs Act stipulates that millers' offals for cattle food must be certified as to fat and albuminoid content. The official American method is as follows: 2 grm. of material, previously dried at 100° C. for 2 hours, is extracted in a Soxhlet (or a Bolton-Revis extractor) for 16 hours with anhydrous ether. The excess of ether is removed and the extract is dried in an oven at 100° C. for ½ hour. It is cooled and weighed and is heated and weighed until constant weight is secured. The receiving flask should have been previously heated to 100° C., cooled and weighed. If the sample contains a large amount of soluble carbohydrates it should be extracted previously with water, dried and ether extraction made as above. In the author's opinion the method of Bolton (*Oils, Fats and Fatty Food*, 1928, p. 11) is much more accurate.

From 3 to 10 grm. of sample are weighed into the inner tube of the Bolton-Revis extraction apparatus, the flask having been charged with about 30 c.c. petroleum spirit. Extraction is continued from 1 to 2 hours. The apparatus is then lifted from the heating bath and after the solvent has ceased to drip the inner tube is removed and laid on its side in a moderately warm place so that the solvent may evaporate spontaneously (too rapid heating of the tube may cause the contents to be ejected). Evaporation of the solvent is facilitated if the contents of the tube be distributed on one side by gentle tapping of the tube. When the solvent has evaporated the tube is placed in a hot-water oven for about 1 hour. The dry material is placed in a mortar together with 1 to 2 grm. clean, dry sand and ground as finely as possible, the contents of the mortar being then carefully brushed back into the extraction tube and the mortar washed out with the solvent. Extraction is then continued for an hour, after which the solvent is distilled off. The flask is then dried to constant weight and the fat weighed directly.

MEASUREMENT OF GAS PRODUCTION

The measurement of gas production is of great importance in the examination of flour for bread making. If the flour does not maintain a sufficiency of gas production in the later stages of fermentation with yeast it will not produce a good loaf. A very simple method, and one still employed in many laboratories, is that of Jago. A dough of flour, water, yeast and salt is placed in a 500-c.c. bottle, which is then stood in a thermostat at 27° C. The gas evolved is measured by displacement of brine from an aspirator. Many variations on this old theme have been evolved from time to time, and a description of a number of these is given in a paper by Elion (*Cereal Chemistry*, 1933, p. 245). This worker pointed out that water displacement gasometers previously described have the drawback that either gas pressure is not maintained constant during the readings or the water volume measured is not equal to the gas produced. He invented a simple water displacement gasometer for measuring gas production during dough fermentation. It is easily constructed and maintains a constant gas pressure during all readings, and the measured water volume is equal to the gas produced.

Markley and Bailey have invented an automatic registering apparatus (*Cereal Chemistry*, 1932, p. 594). Air displaced by the expanding dough is conducted into a bell jar partly filled with water, on the surface of which a buoy is floated. To the buoy a syphon tube is attached, the outlet of which is exterior to the bell jar. As air enters the bell jar, the water in it and hence the buoy is lowered and the syphon discharges water until the hydraulic balance is restored. Thus there is no substantial change in gas pressure in the system. The discharged water is proportional to the volume of displaced air and can be readily recorded on a kymograph chart by collecting the water in a cylinder equipped with a float and stylus. This method is simple and satisfactory.

BRABENDER'S FERMENTOGRAPH

Most laboratories are compelled for reasons of economy to employ home-made apparatus such as described above, and these do give very reliable results. For those, however, who can afford an expensive apparatus, the fermentograph devised by Brabender of Duisberg is the last word in refinement. The apparatus measures the CO_2 developed in the dough during fermentation and records the amount of gas in relation to the time during which it was produced. The dough is enclosed in a balloon and submerged in a water bath. With the development of carbon dioxide the volume of the balloon increases, its buoyancy becomes greater and the consequent weight loss is automatically recorded in the fermentograph. The greater the rate of gas production per time unit the steeper the line on the graph. A declining curve tending to be horizontal shows a decrease in the gassing power properties. The water bath in which the balloon is submerged is kept at constant temperature. It is not necessary here to describe the actual manipulation of the machine, full details of this can be obtained from Brabender, who, by the way, holds courses periodically for English chemists who want to experiment on his methods. The fermentograph gives a diagrammatic representation of three factors: (1) the amount of CO_2 produced, (2) hours of fermentation, and (3) knock back or punch. The higher and steeper the curve begins and proceeds the greater the gassing power. The earlier the curve climbs the earlier the gassing power. Every treatment of the flour which influences gas production—*e.g.*, malt—is depicted in the diagram either in the amount of gas produced or in a shifting of the peaks to an earlier or later period.

BAKING VALUE OF FLOUR

Broadly speaking, the baking value of flour can be expressed by the ratio of dough structure to gassing power. Brabender has devised two machines to determine both these factors. The fermentograph referred to above determines gassing power and the dough structure is determined by the farinograph. In it the resistance of a dough to constant and standard mixing is measured on a dynamometer and recorded on a rotating drum. A curve is obtained which gives a picture of dough consistency, dough development, dough stability, elasticity and distensibility and also dough weakening.

While there are objections and limitations to any scheme that depends on entirely mechanical considerations there can be no doubt that these two machines of Brabender do give extremely valuable information about flour quality and mark the most important of all recent advances in the field.

GENERAL ANALYSES

Apart from the methods described above there are numerous tests to be carried out in connection with flour milling, such as lead and arsenic determinations, analyses of baking powders, and raising ingredients such as tartaric acid, cream of tartar, acid calcium phosphate, sodium pyrophosphate, adipic acid, etc. These, however, follow on stereotyped lines and need no description here. The writer would, however, refer to one determination that has caused trouble—viz., lead in acid calcium phosphate. Eight portions of the same sample were sent to different cereal chemists, and the lead content reported varied between ridiculous limits. One reported 2 parts per million and another 335 parts! As a result of this the methods for determining lead were carefully examined in the writer's laboratory, and the method described by Hamence (*Analyst*, 1932, vol. 57, p. 622) has been adopted with some modifications. It is based on the solubility and insolubility respectively of iron and lead thiocyanates in a mixture of equal parts amyl alcohol and ether. In applying this to acid calcium phosphate the following amended procedure has been adopted: 1 grm. of calcium phosphate is dissolved in 3 c.c. concentrated nitric acid and 17 c.c. water in a glass-stoppered separating funnel and 5 c.c. saturated ammonium thiocyanate solution added. The solutions are mixed, 15 c.c. of amyl alcohol and 15 c.c. of ether are added and the whole vigorously shaken. When the two layers have separated (there is no tendency to the formation of emulsions) the aqueous layer is drawn off and 30 c.c. ammonium citrate solution are added and the mixed solution tested for lead by the sulphide method described in detail in the B.P. If the aqueous solution after extraction still shows a pronounced red colour it must be extracted again with ether and amyl alcohol. By adopting this method any interference by iron (which is present in many samples of acid calcium phosphate) is obviated.

As indicated at the beginning it has only been possible to deal briefly with a big subject, and more stress has been laid on recent developments and tendencies than on detailed descriptions of many methods employed in every cereal laboratory.

YEAST

THE types of yeast important to industry are reviewed by Frey, Kirby and Schultz, *Ind. Eng. Chem.*, 1936, xxvii, 879, and the necessity for purity of strain is stressed. The bacteriology and chemistry of the growing yeast is dealt with both from the laboratory point of view and from the maintenance of ideal conditions in production. The question of yeast as a source for vitamins is dealt with, firstly, under naturally occurring conditions and, secondly, as the result of irradiation. The feeding of cattle with irradiated dried yeast is mentioned, and figures are cited to show that an increase in the vitamin D content of the milk results. Thirty-three references are given.

Some Unsolved

FLAVOURING PROBLEMS

By H. Stanley Redgrove, B.Sc., F.I.C.

SO FAR as I am aware, no satisfactory system of classifying flavours, particularly those of a pleasing character, has ever been formulated. Indeed, although such a system would undoubtedly be of great value to flavouring essence manufacturers, less attention appears to have been paid to this question than to the closely connected one of the classification of odours.

Flavour is an olfactory phenomenon akin to odour; but, in addition to other differences, flavour is always, or nearly always, associated with taste, and to be appreciated must be associated with the *correct* taste. The vast array of fruit flavours, for example, require as a background a taste in which sweetness and acidity are combined, while what are called savoury flavours harmonise well with the taste of salt, though, in some cases at any rate, sweetness is by no means out of place. It is possible that this æsthetic property of flavours might be made the basis of a system of classification. At any rate, in practice a distinction is drawn between the confectionery flavours and the savoury flavours.

It is remarkable how little is known concerning the chemistry of natural flavouring materials.

Confectionery Flavours

Consider the confectionery flavours first. In this group, fruit flavours occupy a position of leading importance analogous to that of floral odours in relation to perfumery. Yet how insignificant is present knowledge concerning the aromatic constituents of fruits compared with that concerning the aromatic constituents of flowers.

The aromatic constituents of only four fruits have been the subject of detailed investigation. These are apples, peaches, American grapes (*Vitis Labrusca* L.), and bananas.

Bananas.—Clemens Kleber (*American Perfumer*, vol. 7, 1913, p. 235) showed that ripe bananas contain *amyl acetate*.

Apples.—Ben Davis, Springdale and Crab apples were investigated by Power and Chestnut (*J.A.C.S.*, 1920, p. 1509). From parings they obtained yields of essential oil corresponding to about 0·0007 to 0·0013 per cent. of the ripe fruit. They describe the oil as a yellowish, somewhat viscous liquid, which darkens on keeping. On cooling, a concrete mass is formed, owing to the separation of small acicular crystals of what is probably a paraffin hydrocarbon. The odorous constituents were found to be essentially *amyl esters of formic, acetic and caproic acids*, plus a very small amount of the *caprylic ester*, and a considerable proportion of *acetaldehyde*. The acids were probably present, in part, in the free state. The aqueous distillate was found to contain traces of methyl and ethyl alcohols, and a small amount of furfurol. The last is almost certainly a decomposition product. In a later investigation of McIntosh apples, which are very aromatic, the presence of *geraniol* either free or in the form of esters was also detected (*J.A.C.S.*, 1922, p. 2938).

On the basis of these investigations the authors took out two patents, dedicated for free use in the U.S.A., for synthetic apple oils, based on the constituents which they had found to be present.

According to Kodoma (*J. Tokyo Chem. Soc.*, 1920, p. 965), certain esters resulting from the decomposition of proteins, such as methyl and ethyl *alpha*-acetoxy-*iso*-hexoate, ethyl *alpha*-benzoyloxy-*iso*-hexoate, ethyl *alpha-iso*-valeryl-*iso*-hexoate, etc., are present as aromatic constituents of apples. Power and Chestnut were unable to substantiate his results.

Peaches.—Power and Chestnut (*J.A.C.S.*, 1921, p. 1725, and 1922, p. 2966) have obtained a very unstable volatile oil from the pulp of this fruit, in a yield of 0·00074 per cent. calculated on the pulp. The aromatic constituents were found to be chiefly *linalyl esters of formic, acetic, valeric and caprylic acids*, plus a considerable proportion of *acetaldehyde*, and a very small amount of *a higher aldehyde*. The acids were probably present in part in the free state.

The pulp was found to contain no hydrocyanic acid or benzaldehyde.

American Grapes.—*Methyl anthranilate* has been identified as an aromatic constituent, though it does not appear to be invariably present. Power and Chestnut (*J.A.C.S.*, 1921, p. 1471) found amounts of this ester varying up to 2 mgm. per litre in red grape juice of the Concord type, and up to 0·2 mgm. per litre in light-coloured juices. In a few cases, negative results were obtained. In a further investigation of the question by Sale and Wilson (*J. Agr. Res.*, 1926, p. 301) the presence of anthranilic acid ester in certain grape juices was confirmed, but a high proportion of negative cases was recorded.

Other Fruits.—Nothing definite appears to be known concerning the aromatic constituents of other pleasantly flavoured fruits. In most instances the aromas suggest the presence of esters of fatty acids, and these form the bulk of the synthetic materials used for the manufacture of artificial fruit flavours. In addition, three so-called "aldehydes" are important, though there is no reason for believing that they actually occur in the fruits whose flavours they simulate. These are *gamma*-undecalactone (so-called "aldehyde C14"), whose aroma is peach-like, ethyl methyl-phenyl-glycidate (so-called "aldehyde C16"), whose aroma recalls that of strawberries, and *gamma*-nonyl-lactone (so-called "aldehyde C18"), with an aroma like that of prunes.

Vanillin is much used in the manufacture of flavouring essences as a "flavour-fixator".

Although these and other materials allow tolerable imitations of a large number of fruit flavours to be made, it is unquestionable that more information concerning the chemical composition of natural fruit flavours would be of very great value to the flavouring essence industry. What substance or mixture of substances gives to the raspberry, the strawberry, the cherry, the plum, the apricot, the pineapple . . . its characteristic aroma? Here are problems crying for solution.

Savoury Flavours

When we turn to the savoury flavours, the lack of knowledge is even greater.

The term "savoury flavour" is rather ambiguous. If an enquiry is directed to any reputable firm dealing in flavouring essences for, say, a sausage flavouring, the firm will undoubtedly be able to supply a product which, *combined with meat*, will admirably produce the required result. But it is to be feared that a request for an essence which will satisfactorily reproduce the flavour of a sausage *in its entirety* will not meet with a like result.

In short, savoury flavours fall into two groups: (i) the flavours of various animal products, such as meat; and (ii) the flavours of the various spices and herbs which blend with flavours of the first group.

The flavours belonging to group (ii), savoury flavours of vegetable origin, are well marked, pungent flavours. The chemical substances responsible for them are mostly well known. The aromatic principles of spices and herbs have, for the most part, yielded up their secrets to the analytical chemist.* Where for any reason it is not desired to use the herb or spice in its crude form, natural extracts or essential oils obtained by steam distillation are available; and, although it would be no arduous task to duplicate these synthetically, actually there is no call for this to be done, as there would, in most cases, be no saving in cost.

Flavours of Animal Origin

The savoury flavours of animal origin are far more subtle in character; and little appears to be known concerning the chemistry of the substances responsible for them.

Text-books give the name "osmazome" to the aromatic material which is produced during the roasting of meat, the odour of which is so stimulating to appetite. But "osmazome" is no more than a mere name. Osmazome, no doubt, is complex in composition; and there are probably numerous sorts of osmazomes corresponding to the various types of meat.

What is the chemical composition of the aromatic material produced by the partial decomposition of game—that aroma which so delights the epicure? Why does the flavour of roast pork differ from that of roast beef, and this, again, from that of roast mutton? Here are unsolved flavouring problems in abundance.

Diacetyl

One exception to the general lack of knowledge concerning the chemistry of animal flavours is butter; and the discovery that the peculiar and characteristic aroma of butter is due to diacetyl must rank as one of the greatest achievements in flavouring chemistry of recent years.

Diacetyl had long been known as a minor constituent of certain essential oils. Among those in which it occurs, mention may be made of the essential oils of cypress, savin, vetiver, orris, West Indian sandalwood, bay, caraway, and angelica root, though, owing to the fact that it is somewhat soluble in water, it is apt to accumulate in the aqueous part of the distillate, when such oils are won by distillation, rather than in the oil itself.

It was not considered to be a constituent of any importance until the discovery in 1929 that this substance, although present in this material only in minute traces, is the aromatic constituent of butter.† Since then, the synthetic production of diacetyl—which is relatively easy—has become of considerable importance, owing to the employment of synthetic diacetyl to improve the flavour of margarine (British Patent 301,750).

Diacetyl is produced in butter as a result of the action of bacterial cultures used as "butter starters", one bacterium specially commended for the purpose being *Streptococcus cremoris*. Actually, the substance formed by the action of the bacteria is acetyl-methyl-carbinol;‡ but this is rapidly oxidised to diacetyl.

Since diacetyl is a normal constituent of butter, there can be no objection to the incorporation of synthetically produced diacetyl in margarine on the grounds that it is toxic in the quantities required, though it has been maintained that diacetyl diminishes the keeping powers of fats owing to its oxidising action, and may possibly have a deleterious action on vitamins. On the other hand, it cannot be denied that it definitely does improve the palatability of margarine.

Mention should also be made of sodium glutamate, owing to the fact that its taste is somewhat meaty. This substance is much used in Japan as a condiment, and is also employed elsewhere to improve the taste of insipid food. Further research, it is understood, is being conducted with other amino-acids with a view to the production of synthetic foods.

* A full account of the chemistry of the aromatic constituents of spices will be found in the present writer's *Spices and Condiments* (London, 1933).

† van Niel, Kluyver and Derx, *Biochem. Zeit.*, 1929, p. 234.

‡ This substance is also available in commerce for use as a butter flavour, and is said to be more stable towards heat than is diacetyl.

INFORMATION and ADVICE

Cut and Mixed Peel—Jelly Cubes—Mould Growth on Marmalade—Pickled Cabbage—Lemon and Orange Oil Extraction—Sediment After Onion Pickling—Fatty Acids in Lard—Pickling of Onions—Orange and Lemon Peels—Chinese Hen Albumen—Diabetic Jam—Honey and Invert Sugar Manufacture—Paste Manufacture—Sweet Vinegar

Cut and Mixed Peel

2,047. *We would like to know what precautions are taken by manufacturers of cut, mixed peel to prevent this line becoming hard and dry in storage, both in large cases and in small cartons.* (Australia.)

No matter what precautions are taken in preparing cut peel, there is always the risk of it becoming hard and dry during storage if the humidity is very low. A fairly dry atmosphere is necessary (about 50° relative humidity) in order to prevent spoilage, but if it becomes too dry, hardening will take place.

Peel which is syruped with a syrup made from one-third of glucose or invert sugar and two-thirds of cane sugar, will remain soft and pliable for a longer period than peel preserved in cane sugar syrup only, since the tendency to crystallise is reduced to a minimum. Also the syruping should be very carefully carried out in stages by increasing the density of the sugar 5° or 10° Baumé for 24 hours. If the peel is treated with too strong a syrup at first there is a tendency for hardening to take place. The density of the final syrup should be about 28° Baumé, after which the excess syrup is drawn off and the peel dried slowly at a low temperature.

Jelly Cubes

2,048. *I obtain a liquid jelly from the process of simmering and evaporating broth and meat. Can you kindly assist me with any information regarding the substance required to obtain a dry jelly sufficiently "rubber-like" in texture to cut into cubes and wrap for marketing?* (London.)

We rather doubt whether you would obtain a sufficiently strong jelly from meat broth alone, and in any case it would have to be evaporated under vacuum. The broth could be strengthened with bones (feet and knees of oxen), and evaporate the mixed liquors to the desired consistency.

So much depends on the scale on which you are working. Powdered gelatine to the extent of at least 20 per cent. could be dissolved in the broth. It would, of course, be necessary to evaporate the broth down considerably before mixing with the tasteless gelatine so that the necessary taste is present in the cubes. An extract of meat could also be added with the other flavourings. The main thing is to see that the gelatine, once added, is not under the influence of heat too long, as otherwise it will lose strength rapidly.

Mould Growth on Marmalade

2,049. *We are British agents for a marmalade which is manufactured in India. The last shipments of this product became very quickly moulded and considerable fermentation took place in another shipment, and we should be glad of any information you are able to furnish regarding the prevention of this. Generally speaking, the procedure is to cook the product in large open copper cauldrons, and the length of time of cooking depends on the colour and consistency of the syrup, and is judged by the operator; thus you will quite understand that variations easily occur. The fault apparently lies in the temperature; this cannot be high enough to inhibit mould growth. We are wondering if the insertion of a wax cork immediately after bottling would check the mould growth?* (Liverpool.)

The fermentation mentioned is obviously due to underboiling, and it is certain that the marmalade which fermented must have contained considerably less than 70 per cent. of soluble solids. The insertion of a waxed cork would not prevent fermentation nor mould growth, although it would certainly lessen the latter.

The best way to avoid fermentation is to provide some means, such as a refractometer, by which the percentage of soluble solids can be ascertained. The boiling should be continued until the soluble solids reach from between 70 and 75 per cent. Alternatively, some degree of uniformity may be attained if the marmalade is boiled at, say, 224° F. before the steam is turned off. Marmalade boiling at this temperature would then always have a soluble solid content of approximately 70 per cent.

Pickled Cabbage

2,050. *Our pickled cabbage is showing a tendency to ferment. Are you in a position to give us any reason for this unprecedented event? We would add that the top of the bottle is showing a white filmy appearance.* (Manchester.)

Fermentation and also the white film might be due to many things; for instance, low percentage of vinegar, acetic acid, wet bottles, etc. We are therefore giving you another recipe for the brining and pickling of red cabbage, and we trust that you will find this quite satisfactory. Cut up the cabbages and place in an empty cask with the head out. Place 28 lb. of bay or dairy salt on the cabbage and fill the cask with cold water. Stand overnight. The following day place the cabbages in

baskets and when well drained mix in 4 oz. broken whole ginger, 4 oz. whole allspice, and 4 oz. Japanese chillies. Place all in cask and head up. Fill through the bunghole with a solution of acetic acid and water—*i.e.*, 3¾ gal. of 80 per cent. acetic acid to 46 gal. of water. Bung tightly and the next day completely fill with the acetic acid and water solution. They should be allowed to stand for fourteen days before filling into bottles.

If vinegar is used, 24 gr. pale malt is best.

Lemon and Orange Oil Extraction

2,051. *We should be obliged if you could give us some information about the method of taking out essence of lemon by hand, and the same information for oranges. We believe there is a sponge pressing arrangement of some simple hand system, about which you may perhaps be able to give us some information.* (London.)

The sponge method of extracting these oils is one which is still used extensively in Italy. The oranges or lemons are either cut in two across the short axis and the pulp scooped out with a curved knife, or the fruit is cut by making two cuts down the long axis and the peel is removed in three pieces. In the case of the former, a small sponge is pressed into the cuplike pieces of peel and the oil pressed out, either by hand or by mechanical means. If done by hand, the sponge is usually fixed to a wooden stick. The expressed oil is run into receptacles and allowed to stand, so that any juice or water soluble part sinks to the bottom, whilst the lemon oil is at the surface. It is then separated and filtered if necessary.

Sediment After Onion Pickling

2,052. *After we have pickled onions we find sediment at the bottom of the jar. Our process is as follows: The onions are peeled, washed, and put in brine water for 48 hours, after which they are bottled in spiced vinegar. Can you suggest a remedy for this, please?* (Wales.)

It is difficult for us to give any precise information on this question without knowing the particular type of onion you are using.

After the onions have been placed in the salt and water (which should be 2½ lb. of pickling salt to each gallon of water) they should be placed in a solution of acetic acid and water for 48 hours or more before placing in bottles. After this the bottles should be drained for an hour or so before putting in the spiced vinegar.

Fatty Acids in Lard

2,053. *Kindly give me detailed account of the necessary process to estimate the percentage of fatty acids in secondary lard and the apparatus necessary for same, also how to estimate the percentage of moisture.* (Cavan.)

If the material is almost neutral it is possible to dry it in flat bottomed dishes at 105° C. until constant; the material can be first dried for one hour and then weighed, afterwards being replaced for a further period of half an hour until constant.

For the determination of the fatty acids, from 1 to 10 grm. is weighed out and 50 c.c. neutral alcohol and benzene added (the alcohol-benzene mixture is made from equal quantities of methylated spirit and benzene), the material being warmed and then titrated with n/10 or n/2 alcoholic potash and calculated as oleic acid.

Pickling of Onions

2,054. *Will you kindly let us know the name of the best silver skin onions to buy for pickling, the best time to purchase, and the best method of pickling same?* (Sheffield.)

With regard to the best type of onion, this is purely a matter of taste, but generally speaking they are all very much alike. The pickling time depends on the season; this year it would probably be in the latter months.

The main point in the pickling process is to avoid all utensils made from iron and also to see that the water used is free from iron.

After the onions are peeled they should be placed in a cask (which should not be made from oak or chestnut). Head up and fill through the bunghole with a brine made up of 3 lb. of pickling salt to each gallon of water. Replace the bung in such a position that the gas is allowed to escape. Allow to stand for 48 hours and then run off the brine.

To each 50-gal. cask add 2 oz. of meta-bisulphite of potash and then fill with a brine of 3½ lb. pickling salt to each gallon of water. Bung up very tightly. For the next 3 days see that the cask is filled with brine, after which allow to stand for 10 to 12 days.

Pickling

Run off the brine and fill the cask with hot water at 180° F. Allow to stand overnight; run off the water next day and bung tightly. Stand the cask on end and take out the head. Cover the onions in the cask with a solution of 4 per cent. acetic acid and water. Allow to stand for 24 hours and then fill into jars, using a red finger pepper and a few white mustard seeds in each, together with a 5 per cent. solution of acetic acid and water or white wine vinegar.

Orange and Lemon Peels

2,055. *Could you give us information regarding the process for making orange and lemon peels from fresh rinds for baking purposes?* (Ayrshire.)

The fresh peels (which should be cup shaped) are first treated with a brine solution containing 1½ lb. salt to 1 gal. of water.

After several weeks the peel is removed and drained and rinsed in water. Finally, the peels are heated to about 110° F. in three or four changes of fresh water in order to remove the last traces of salt.

The skins are drained again on a wire gauze and then packed carefully, one inside the other, into a tank containing sugar syrup of 18° Brix. strength. After 24 hours this syrup is run off and more sugar added to it to build up to 35° Brix.

This syrup is then used to cover the peel for a further 24 hours, after which the same process is repeated at a strength of 45° Brix. It is again repeated at a strength of 52° Brix., all these syrups being poured on boiling hot. Finally, the peels are drained on wire trays and dried in a properly ventilated room at about 120° F. for 12 hours.

Chinese Hen Albumen

2,056. *We should be glad to know if you have any details as to the method of manufacture of Chinese hen albumen. We know that ammonia is used to assist evaporation of the moisture and that it is kept in shallow trays in a temperature controlled chamber, but of the details of the process we seem to have lost our records, and it occurred to us that you might be able to assist.* (London.)

It is presumed that dried whole egg is referred to.

After separating the white, the acidity is adjusted by the addition of dilute ammonia to about *p*H 8.0. This stabilises the protein somewhat and reduces the risk of coagulation during drying. The drying process is carried out in open trays exposed to the sun or in drying rooms, and the temperature is not allowed to rise above 113° F.

According to American practice, when vacuum drying is used instead of sun drying, a somewhat higher temperature (120° F.) is used. When dry the flaked mass is either broken up or ground to a powder, with the usual precautions to prevent undue heating.

Diabetic Jam

2,057. *We understand that glycerine is regarded as an unsatisfactory substitute for sugar in diabetic jam. We would like to know the most recent developments in the manufacture of this line and how it is being made now not using glycerine.* (Australia.)

The usual method, we have been informed, is to exclude all sugar and obtain the "set" by means of gelatine. The sweetening is provided for by the addition of saccharine. A typical recipe is as follows:

Fruit	6 lb.
Saccharine	80 gr.
Water	5½ pints
Gelatine	¼ lb.

The fruit is simmered in the water until tender, and the volume made up from time to time to allow for any loss due to evaporation. The gelatine is cut into small pieces and soaked in a small quantity of water, and stirred into the cooked fruit, together with the saccharine. The jam is poured in the usual way and allowed to set.

Owing to the lack of sugar the keeping qualities of this jam are poor, but it may be improved by adding sulphur dioxide (in the form of potassium meta-bisulphite) at the rate of 40 parts per million.

Honey and Invert Sugar Manufacture

2,058. *We shall be obliged if you can give us particulars regarding the manufacture of imitation honey and invert sugar.* (Edinburgh.)

IMITATION HONEY

Water	9 gal.
White sugar	45 lb.
Glucose	45 lb.
Refined maple sugar	10 lb.
Honey essences	2 fl. oz.

Place the water in a steam pan and bring to the boil. Add the sugars, stir well, and bring again to the boil. Then add the glucose, mix well, and boil to 238° F. Skim well and add the essences, which should be well stirred in. The product should be added while in a hot condition.

LIQUID INVERT SUGAR

Water	5 gal.
White sugar	50 lb.
Cream of tartar	4 oz.

Place the water in a steam pan and bring to the boil. Add the cream of tartar, stir well, and add the sugar. Mix thoroughly until all the sugar is dissolved. Then pass through a filter bag and return to the steam pan and boil to 240° F., after which it should be placed in a pan or tub until cold.

If a solid product is required it should be boiled to 290° F., then poured into tins until cold and then broken up into pieces.

Paste Manufacture

2,059. *Can you please furnish me with information and recipes for the manufacture of pastes which will utilise oddments of bacon, beef, ham, etc., in order to avoid waste?* (Somerset.)

The possible variations in paste manufacture are so numerous that it is better to indicate the general principles than offer any specific formula.

In addition to your oddments of bacon, cooked tongues, etc., you could incorporate wheat flour and rusk. Rusk has the property of absorbing moisture and also fat, and may be added in the proportion of anything from 10 to 20 per cent. of the total weight, according to the grade of paste required.

If the meaty material is not too fat in itself, fat should be added, as it aids in the production of smoothness. Another material which gives a good effect is liver, which should be added to the paste in the raw state. Stock of any kind may be added instead of water. Flavouring may consist of onion powder, pepper, spices (mixed), sugar, parsley, and, of course, salt.

Sweet Vinegar

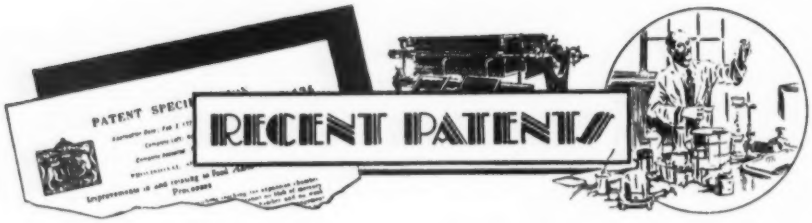
2,060. *Would you please let us have a recipe and instructions for the manufacture of sweet vinegar?* (Sunderland.)

A typical formula is as follows:

Vinegar (18 gr.)	74 gal.
White sugar	512 lb.
Spices	6 oz.

Place vinegar in a steam pan (which should not be made from iron) and add the sugar. Stir well, put on the steam and bring to the boil. Shut off the steam, skim well, and add spices.

Spices for the vinegar could be oil of cloves, oil of pimento, and oil of cassia, all well mixed together.



These particulars of New Patents of interest to readers have been selected from the "Official Journal of Patents", and are published by permission of the Controller of H.M. Stationery Office. The "Official Journal of Patents" can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, price 1s. weekly (annual subscription £2 10s.).

Latest Patent Applications

23618. KRAFT-PHENIX CHEESE CORPORATION: Drying of whey. August 28.
23640 and 23641. JEFFERIES, W., and PEIRCE, LESLIE AND CO., LTD.: Apparatus for extracting cashew nut-shell oil. August 28.
23796. HEJTMAN, H.: Valve closures for food-preserving vessels. August 31. (Czechoslovakia, September 2, 1935.)
23889. TIETZ AND UNTERBERG: Preservation of foodstuffs. September 1.
24011 and 24012. HARBER, L. S.: Treatment, etc., of dough. September 2.
24116. TREU, E.: Container for food preserves. September 3.
24243. CARSONS, LTD., and PAYNE, A. G.: Moulds for chocolates, etc. September 4.
24296. BRUCE, J. A.: Packaging process for beverages. September 5. (United States, September 6, 1935.)
24371. SCHIMMEL, F.: Apparatus for sealing preserving glasses, etc. September 7.
26379. LANYON, E. N.: Production of fruit juices. September 29.
24421. COWAN, A. F.: Containers for food. September 7.
24575. GEORGE, H.: Fruit-grading machine. September 9.
24618. WEYLER, J.: Product for preserving cereals, etc. September 9.
24846. DU PONT DE NEMOURS AND CO., E. I.: Protein compositions. September 11.
24888. FOSCHI, L.: Biscuits, etc. September 12.
25153. REWALD, B. A.: Treatment of yeast. September 15.
25242. FOWLER, J. O.: Treatment of milk. September 16.
26098. AVELING-BARFORD, LTD., WHITING, T. H. B.: Steam, etc., cookers. September 25.
26232. BOTTOMLEY, F.: Confectionery. September 28.
26310. BAADER, R.: Machines for dressing fish. September 28.
26327. WALKER, T. R.: Treatment of cereals. September 29.
26366. BATE, E. J.: Butter, etc., moulding machines. September 29.
26369. SCHER, I.: Meat-examining device. September 29.
26370. WEBSTER, R. W.: Steam, etc., cooking apparatus. September 29.
26427. KLEINERT, T.: Production of savouries, etc. September 29.
26428. KLEINERT, T.: Production of savouries, etc. (Cognate with 26427.) September 29.
26462. CHALIHA, J.: Method of drying tea, etc. September 30.

Complete Specifications Accepted

452,515. FAIRRIE, J. L.: Treatment of beet pulp.
452,682. EKHARD, DR. W.: Process for improving the keeping properties of, and removing the bad taste and odour from, animal and vegetable materials.
453,054. STAHL, C.: Paring machines for fruit and vegetables. (March 5, 1934.)
453,129. SANCHEZ, P.: Treating sugar. (April 9, 1934.)
453,417. ROBINSON, R. W., and OLSEN, JUNR., A.: Candy product and process.
453,420. ROGERS, F. H. (SPRECKELS SUGAR CO.): Method and apparatus for recovering sugar.
453,877. DEHN, F. B. (CALIFORNIA FRUIT GROWERS' EXCHANGE): Method of treating pectin to alter the inherent setting-time characteristic thereof.
453,828. DARRINGTON, T. A.: Method and means for salting the intestines of animals prior to the use of said intestines as sausage skins.
453,937. LOVE, W. DE L.: Apparatus for heating and buttering nuts.
454,106. BEECH'S CHOCOLATES, LTD., and COLLINSON, E. W.: Holders for confections.
454,220. BLAND, F. O. S.: Preservation of perishable articles by freezing.

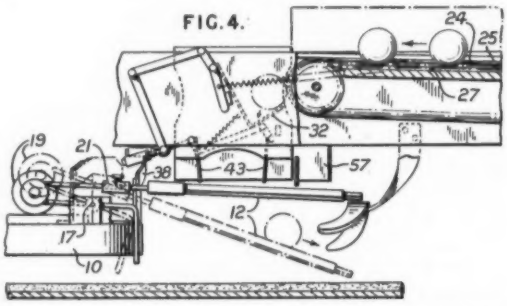
Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, at the uniform price of 1s. each.

Abstracts of Recent Specifications

Group Abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, either sheet by sheet as issued on payment of a subscription of 5s. per Group Volume, or in bound volumes price 2s. each.

446,753. GROUP XVIII. **Grading eggs, etc., by weighing.** BINGHAM, G. C., The Friary, Maldon, Essex.
In a machine for grading eggs, etc., the eggs are moved, or permitted to gravitate, along equally poised balance runways as these are moved bodily in a predetermined path, until the increasing movement of the egg tips the balance and discharges the egg to its grade compartment. The balance runways 12, Fig. 4, mounted on fulcra 17 are disposed equidistantly upon a continuously rotating head 10 and are inclined downwardly and outwardly. The inner ends carry counterpoise weights 19 in the form of rollers bearing upon the surface of the head 10. Auxiliary adjustable weights 21 are also provided on the balances. The eggs may be placed on the balance runways by hand or by means of a conveyer belt 24 provided with circular holes 25 into which the eggs are placed. As the eggs are advanced they roll along a rubber strip 27 of less width than the diameter of the holes and are caused to position themselves with their long axes at right angles to the direction of travel. The leading egg falls into a pivoted **V**-shaped carrier 32, which is rocked by a cam 38 so as to drop the egg on to two pivoted flaps 43 (shown open). The pivoted flaps are then opened by the cam to drop the egg gently on to the balance runway. As the balance runways are carried round, the eggs roll outwardly and abut against a stationary eccentric wall which allows the eggs to move gradually along the runways until tilting occurs and

FIG. 4.



the eggs escape beneath the wall and run into their grade compartments. An inner eccentric wall ensures that the eggs shall move towards the outer wall. A stationary guide plate 57 sweeps the ungraded eggs off the runways. Stops limit the tilting movements of the balances. The apparatus may be in duplicate form. The carrier 32 and flaps 43 may be dispensed with. The eccentric wall for permitting the gradual outward movement of the eggs may be dispensed with, in which case the balance runways are normally horizontal and the eggs are displaced along the runways by cam-controlled slides.
449,246. **Extracting fish-liver oils.** WARD, J. E., The Crookes Laboratories, Gorst Road, Park Royal, London.
Oils are separated from fish livers, such as halibut livers, by treating the minced livers with dilute alkali, separating the resulting scum and treating it with hot water, adjusting the hydrogen ion concentration to faint alkalinity, causing the emulsion to break with addition, if necessary, of an electrolyte, and separating the oil. Minced halibut livers are treated with 5 per cent. caustic soda solution at 40° C. for several days. The oily scum is separated, and after treating with boiling water the mixture is adjusted to *p*H8 by adding hydrochloric acid. Breaking of the emulsion may be assisted by addition of anhydrous sodium sulphate. The oil is then separated by centrifuge.

449,428. **Preserving milk, fruit juices, etc., by evaporation.** HENKEL AND CIE, GES., 67, Heyestrasse Holthausen, Düsseldorf, Germany.

Flocculation of milk, plant juices, etc., on evaporation is prevented by the addition of small quantities—*e.g.*, 0·1 to 1 per cent.—of soluble alkali polyphosphates as colloid stabilisers. The polyphosphates may be used in conjunction with other known stabilising agents or with soluble salts of phosphoric acids containing less water than ortho-phosphoric acid—*e.g.*, pyrophosphates or hypophosphates. The choice of polyphosphate is dependent on its *p*H value, which preferably agrees with the *p*H value of the colloid.

The specification as open to inspection under Sect. 91 describes also the use of polyphosphates with stabilisers consisting of decomposition products of albumins—*e.g.*, lysalbinic acid. This subject-matter does not appear in the specification as accepted.

449,526. **Food preparations; biscuits.** GRAVES, H. C. H., and VITAMINS, LTD., 23, Upper Mall, Hammersmith, London.

Biscuits rich in vitamin B are prepared by mixing a ground and stabilised material rich in vitamin B with a cereal flour, adding water or milk, fat—*e.g.*, butter—and a flavouring, and rolling and cutting into biscuits which are baked at an oven temperature not over 415° F. for not over 21 minutes until a uniform pale brown-yellow colour not due to singeing is acquired. The material containing vitamin B, which may be brewers' or distillers' yeast, rice bran or polishings, cereal germs or a vitamin B concentrate, and the cereal flour, which may be wheat, oat, or rice flour, may be used in equal parts by weight. The material containing vitamin B may be dried and rolled before stabilising, which may be effected by removing or rendering inert contents giving rise to or assisting putrefaction or like degenerative change, without adding preservatives, for example, by the process described in Specification 369,556. In an example, ground cereal germs are mixed with oat flour and milk, sugar and fat added, and the mixture is baked for 17 to 19 minutes or less at an oven temperature not above 415° F.

450,117. **Process for preparing a soluble food extract from brewers' yeast.** J. H. MILLAR, 52, Watling Street, Dublin, and A. GUINNESS, SON AND CO., LTD., Salisbury House, Finsbury Circus, London, E.C. 2 (St. James's Gate Brewery, Dublin, Irish Free State).

Liquefied and digested yeast extract, produced by peptonisation or autopeptonisation of the yeast, is diluted and separated in a centrifugal filter and separator, then concentrated *in vacuo*, to remove undesirable flavours and unwanted solids, and recentrifuged. Activated carbon (0·75 to 1·0 per cent.) is then added to the extract at 70° C. and well stirred for one hour, to effect debittering. The resultant extract is separated in a plain centrifuge, and the black liquor, which still contains colloidal carbon, is brightened by combined centrifugal separation and filtration. It is claimed that this method removes all, or practically all, the carbon. The design of the centrifugal filter is described and illustrated (*cf.* E.P. 450,130-1); the filtering medium is preferably a 2-inch layer consisting of 60 to 80 per cent. cellulose and 40 to 20 per cent. asbestos. The extract is then evaporated *in vacuo* to a thick paste, when unwanted solids are precipitated and carry down residual carbon; the extract is redissolved in hot water (97·8° C.) to destroy proteolytic enzymes, and the solution is centrifuged and finally evaporated to a thick paste constituting the product desired. (Convention date, Irish Free State, June 22, 1934.)

451,277. **Means for carbonating water and beverages.** J. G. CAMERON, 184, Breakfast Creek Road, Newstead, Brisbane, Queensland, Australia.

A gas-tight chamber is divided into two inter-communicating portions by a bowl or pipe, closed at the lower end except for the supply pipe from a gas chamber; the latter enters at the bottom via a non-return valve, and projects slightly into the inner compartment, having the upper end closed, with side perforations to produce a lateral spraying effect. The water inlet is fitted with a non-return valve and is either (1) at the middle of the top of the chamber, so that the water descends into the inner compartment, or (2) at the side, the tube extending down to the bottom; the draw-off pipe also descends to near the bottom, and is at the side in case (1) and in the middle in case (2). A connecting tube at the top of the chamber leads surplus gas back, via a non-return valve, to the gas chamber (which also connects with the gas supply via a valve). The pressure of the gas supply is adjusted to be a little less than that of the water, so that once the air is displaced from the chamber the supply of carbonated water is continuously maintained as long as the draw-off pipe is opened.

451,282. **Conditioning of chilled meat in storage or transit.** SMITHFIELD AND ARGENTINE MEAT CO., LTD., St. Bartholomew House, 58, West Smithfield, London, E.C. 1, and J. A. Brewster, 314, Reconquista, Buenos Aires, Argentine, South America.

To prevent the formation of ice crystals in the muscular tissue of chilled meat, the latter is kept heated just above freezing point by the passage of an electric current of suitable voltage and frequency. Electrodes, suitably of stainless steel, to obviate corrosion, are inserted at the ends of the quarters or pieces of meat hanging in the refrigerating chamber, and a suitable alternating current is passed. The internal temperature may be controlled by means of long-distance electrical or mercury thermometers inserted in the meat at appropriate central points.

451,354. **Manufacture of mineral water and the like.** O. A. ELIAS, 123, Waller Road, London, S.E. 14.

An upright cylinder with a domed top, capable of withstanding 100 lb. pressure, is used as a saturating chamber for the production of a gas enriched in radioactive constituents, for use in the manufacture of mineral water of a homeopathic standard. A layer of clean, steam-washed coke is placed at the bottom of the cylinder, with a thick layer of granulated coke and fine gravel on top. A thick stratum of monazite sand, with or without uranium ore and a radioactive concentrate, is placed above this, up to about half the height of the cylinder. The cylinder is filled with water up to about 1 ft. from the top (a side tap may be fitted to control the level). Carbon dioxide is passed in at the bottom until the pressure is about 30 to 50 lb., the air having been first displaced. The chamber is maintained thus, with any necessary pressure adjustments, for three weeks. A portion of gas is then gradually drawn off from the top into a reservoir, the pressure in the cylinder being constantly maintained at 30 lb.; the gas is highly radioactive, and is then used for manufacturing mineral water. The activated water in the cylinder may also be drawn off from the bottom. The contents of the cylinder must be left for 24 hours to recuperate after each withdrawal of gas.

452,233. **Processes for treating cereals and grain.** DR. L. SCHWAB, Ernst-Ludwig-strasse 23, Darmstadt, Germany.

The treatment of cereals with sodium bisulphite solution to sterilise and loosen the husks of cereals, and so facilitate shelling and grinding, suffers from the disadvantages that the baking properties of the flour are affected, and that sulphur dioxide is evolved during treatment. These disadvantages are obviated by the use of a sodium bisulphate solution, with which the grain is left in contact for a substantial period of time. The solution —for example, ½ kgm. of 25 per cent. $NaHSO_4$ solution per 100 kgm. of wheat—is applied to the cereal by any suitable means—for example, by introduction into the working space of a screw conveyor—and the moistened grain is stored in a silo for 12 hours before grinding. An increased yield of meal of a better colour and lower ash is obtained when using this process. The baking properties are not affected. (Convention date, Germany, July 13, 1934.)

452,483. **Making leavened bakery products and compositions therefor.** STANDARD BRANDS, INC., 595, Madison Avenue, New York, U.S.A.

The dough-maturing effects of potassium bromate are improved by the addition of minute amounts of a vanadium compound; any of the water-soluble vanadium compounds may be used—for example, vanadyl sulphate, di-vanadyl sulphate or chloride, sodium or ammonium ortho or meta-vanadate. The amount of vanadium to be used is from 0·2 to 0·6 parts per million parts of flour. Other know bread-improving chemicals may be added, and a baking powder of composition such as $CaHPO_4$ 0·2, $(NH_4)_2SO_4$ 0·028, $KBrO_3$ 0·0005, KIO_3 0·0004, $NaVO_3$ 0·00006, NaCl 0·08 and flour 0·0911 parts may be used with 100 lb. of flour. It is claimed that the dough has a tougher and more homogeneous and flexible consistency, and that the bakery products are of finer, silkier texture, with an improved colour of crumb. The action of the vanadium is considered to be of a catalytic nature. (Convention date, U.S.A., February 21, 1934.)

LATEST TRADE MARKS

This list of Trade Marks of interest to readers has been selected from the "Official Trade Marks Journal", and is published by permission of the Controller of H.M. Stationery Office. The "Trade Marks Journal" can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, price 1s. weekly (annual subscription £2 10s.).

DUCHESS.—564,300. **Eggs.** The Duchess of Devonshire Dairy Co., Ltd., Tiverton Junction, Cullompton, Devon. October 7. (Associated.)

Eggs and goods of a like kind will be struck out from the goods of Registration No. 514,304 (2736) if and before the applicants' mark is registered.

TRA-DESTA. — 569,117. **All goods in Class 42.** British Meat Packing Co., Ltd., 34, Castle Street, Liverpool, 2. October 7.

SAMPLER TEA.—569,436. **Tea.** John Edward Ellis, 15, The Croft, West Derby, Liverpool, 12. October 7.

Registration of this trade mark shall give no right to the exclusive use, either separately or in combination, of the devices of a teapot and a teacup.

ELIZABETH CRAIG.—571,029. **Essences (not alcoholic), flavourings (not alcoholic) for foods and beverages, and colouring matters for use as ingredients in food.** The London Essence Co., Ltd., Lorresco Works, 53, Glengall Road, Peckham, London, S.E. 15. October 7.

The portrait appearing on the mark is that of Miss Elizabeth Craig.

MOUNTAIN DEW.—571,464. **Tea and coffee.** Lillico and Van Den Bergh, Ltd., 33, Trinity Square, London, E.C. 3. October 7.

ECHO.—569,392. **Dried fruits, jams and preserves (for food), tea, and self-raising flour.** Charles Ernest Holmes, Albert Street, Tunstall, Stafford. September 30. (Associated.) (By Consent.)

TRUE FRIEND.—570,584. **Tea.** Portsea Island Mutual Co-operative Society, Ltd., 48, St. Mary's Road, Portsmouth, Hampshire. September 30.

Registration of this trade mark shall give no right to the exclusive use of the letters "T. F."

APIS.—570,765. **Dried fruits.** Barry Brothers, Ltd., 37, Victoria Street, Liverpool, 1. September 30.

MARMION.—565,696. **Cooking oils and cooking fats.** Thomas Hedley and Co., Ltd., Phœnix Buildings, Collingwood Street, Newcastle-on-Tyne. September 30. (By Consent.)

BREL.—570,916. **Cheese and cheese products (for food).** Kraft Cheese Company, Ltd., Silverdale Road, Hayes, Middlesex. September 30.

KELLOGG'S RICE KRISPIES.—B 569,405. **A food made of rice, for human consumption.** Kellogg Company of Great Britain, Ltd., Bush House, Aldwych, London, W.C. 2. September 30.

User claimed from October 27, 1928.

The applicants undertake that this mark, when registered, and the marks Nos. 552,122 (2971), 552,408 (2969), B 552,409 (2976), and 552,557 (3018), shall be assigned or transmitted only as a whole and not separately.

MIREME.—570,920. **All goods in Class 42.** Ludwig de Leopold, Abford House, 15, Wilton Road, Victoria, London, S.W. 1. September 30.

NEW COMPANIES

E. T. Baker (Maldon), Limited. (318,432.) Fullbridge Mills, Maldon, Essex. To take over the bus. of flour millers cd. on at Maldon, Essex, as E. T. Baker and Son. Nom. Cap.: £25,000. Dirs.: W. Douglas-Brown, Reddings, Tillingham, Essex (permanent governing director); E. T. Baker, Fullbridge, Maldon, Essex; T. L. Baker, Fullbridge, Maldon, Essex.

British Emulsifiers, Limited. (318,509.) Princes Works, 93, Stanley Road, Teddington, Middlesex. To acquire the undertaking of British Emulsifiers, Ltd., and to carry on the bus. of mnfrs. of and dlrs. in emulsifiers, cream-making machines, milk separators, etc. Nom. Cap.: £70,000. Dirs.: Sir Alexander M. Rouse, Kt., C.I.E., Aubrey House, Twickenham; F. B. Day, 63, Latchmere Road, Kingston-on-Thames; A. R. Bannister, 14, Darby Crescent, Sunbury-on-Thames; C. S. Kilmister, 78, Langham Road, Teddington.

British Pedigree Sugar Beet Seed, Limited. (318,363.) To carry on the bus. of producers of and dlrs. in sugar beet seed, etc. Nom. Cap.: £5,000. Dir.: S. O. Ratcliff, address not stated. Subs.: S. H. Cotton, 23, Hurst Road, Sidcup, Kent (clerk); G. A. Hunt, 6, Ridgway Gardens, S.W. 19 (clerk).

Coronet Chocolates, Limited. (318,864.) 1, Featherstone Buildings, High Holborn, W.C. 1. To carry on the bus. of chocolate mnfrs., etc. Nom. Cap.: £100. Dirs.: B. H. Goldbard, 194, Hale Lane, Edgware, Middlesex; R. G. L. Bocking, 17, Lewin Road, Streatham.

Dogdom, Limited. (318,980.) 2A, Oaklands, Welwyn, Herts. To carry on bus. as importers of and drls. in foodstuffs, dogs and other animals, etc. Nom. Cap.: £100. Dirs.: W. Davison, The Old House, Potters Heath, Welwyn, Herts (permanent chairman); G. M. Potts, The Kennels, Welwyn.

Everett (Tonbridge), Limited. (318,269.) To carry on the bus. of mnfrs. of and dlrs. in confectionery, bakers, etc. Nom. Cap.: £1,000. Dirs. F. E. W. Empson, 39, Grosvenor Park, Tunbridge Wells; Mrs. O. B. Empson, 27, Madeira Park, Tunbridge Wells.

Exors. Herbert Lees, Limited. (318,985.) To take over the bus. of botanical brewers cd. on at Stamford Botanical Works, Hurst, Ashton-under-Lyne, as "Executors of Herbert Lees." Nom. Cap.: £3,000. Perm. dirs.: R. Lees, 141, King's Road, Ashton-under-Lyne; A. Lees, 141, King's Road, Ashton-under-Lyne.

Hammans Trading Company, Limited. (317,984.) To carry on the bus. of importers and mnfrs. of and dlrs. in chocolate, cocoa, wines, etc. Nom. Cap.: £3,000. Dirs.: Not named. Subs.: A. Wilson, 62, Myddleton Square, E.C. 1 (secretary); H. C. Wisenden, 114, Hillside Gardens, Barnet (clerk).

Lactic Creams, Limited. (318,425.) To carry on the bus. of mnfrs. of cheeses, butter, cream, etc. Nom. Cap.: £900. Dirs.: To be appointed by the subs. Subs.: F. M. Dupre, 11, New Court, Carey Street, W.C. 2; Winifred M. Isaac, 18, Canonbury Place, N. 1 (clerk).

Layton-Burr Manufacturing Company, Limited. (317,987.) To take over the bus. of manufacturing confectioners, etc., formerly cd. on by C. Rhodes and N. H. Carr at Windmill Road, Croydon. Nom. Cap.: £2,000. Dirs.: C. Rhodes, 4, Broughton Road, Thornton Heath; N. H. Carr, 12, Sydenham Road, Croydon. Qual. of dirs.: £100. Remun. of dirs.: As voted by the company.

Lestoffe, Limited. (318,372.) To take over the bus. cd. on at Kirkley, Lowestoft, as "Lestoffe and Co.," and to carry on the bus. of mnfrs. of and dlrs. in food products, etc. Nom. Cap.: £500. Dirs.: J. Chadwick, Green Farm, Blunderton, Lowestoft; F. Sewter, 123A, Carlton Road, Kirkley, Lowestoft.

Lincoln Produce Company, Limited. (319,003.) Guiness Stud Farm, Dudden Hill Lane, N.W. 10. To carry on the bus. of dlrs. in and producers of dairy, farm and garden produce, etc. Nom. Cap.: £1,100. Dirs.: L. J. Sparke, 97, Valley Drive, Kingsbury, N.W. 9 (chairman); A. E. Sparke, 63, Valley Drive, Kingsbury, N.W. 9; G. W. Kenzie, address not stated.

The above-mentioned particulars of new companies recently registered have been extracted from the daily register of Messrs. Jordan and Sons, Ltd., company registration agents, Chancery Lane, W.C. 2.